RESTRICTED

# INSTRUCTIONS

FOR

## RADIO RECEIVING EQUIPMENT

MODEL RAS-2 SERIAL [redacted]

FREQUENCY RANGE: 190 TO 30,000 KCS.

SUPPLY: 115 VOLTS, 60 CYCLES, SINGLE PHASE

EQUIPMENT CONSISTS OF FOLLOWING UNITS

| | |
|---|---|
| CNA - 46080 | RADIO RECEIVER |
| CNA - 20090 | POWER UNIT |
| CNA - 49105 | LOUD SPEAKER |
| CNA - 10037 | COIL SYSTEM CONTAINER |
| CNA - 47156 | COIL SET 190 TO 450 KCS. |
| CNA - 47157 | COIL SET 450 TO 900 KCS. |
| CNA - 47158 | COIL SET .90 TO 2.0 MCS. |
| CNA - 47159 | COIL SET 2.0 TO 4.0 MCS. |
| CNA - 47160 | COIL SET 4.0 TO 7.0 MCS. |
| CNA - 47161 | COIL SET 7.0 TO 14.0 MCS. |
| CNA - 47162 | COIL SET 14.0 TO 30.0 MCS. |
| CNA - 10036 | MOUNTING RACK |

SEE LICENSE NOTICE INSIDE

NAVY DEPARTMENT

BUREAU OF SHIPS

CONTRACTOR

GENERAL ELECTRIC SUPPLY CORP.

WASHINGTON, D. C.

CONTRACT NOs. - 79121 CONTRACT DATE: 22 NOV. 1940

C-755


NATIONAL COMPANY, Inc.

MALDEN, MASS.

U. S. A.

**RESTRICTED**

# INSTRUCTION BOOK

FOR

# RADIO RECEIVING EQUIPMENT

## MODEL RAS—2

| | |
|---|---|
| Frequency Range | 190 to 30,000 Kcs. |
| Supply 115 Volts | 60 Cycles one Phase |

## NAVY DEPARTMENT

**Bureau of Engineering**

CONTRACTOR

## General Electric Supply Corp.

**Washington, D. C.**

MANUFACTURED BY

## NATIONAL COMPANY, Inc. MALDEN, MASS., U. S. A.

Contract Nos. 79121 Dated November 20, 1940 Schedule S. 500.2102

## RESTRICTED

This instruction book is furnished for the information of commissioned, warrant, enlisted and civilian personnel of the Navy whose duties involve design, instruction, operation and installation of radio and sound equipment. The word "RESTRICTED" as applied to this instruction book signifies that this instruction book is to be read only by the above personnel, and that the contents of it should not be made known to persons not connected with the Navy.

## GUARANTEE

All items used in this equipment, except vacuum tubes, will be guaranteed by the contractor for a period extending one year from the installation date of the equipment, provided that in no case will the guarantee extend longer than two years after the date of acceptance. This guarantee will cover items failing in normal operation and the contractor will replace these at no cost to the Government and with transportation charges prepaid to destination. If the contractor elects to have the defective unit returned to his plant for examination, he will be required to pay the transportation charges.

## NOTICE

The model RAS-2 radio receiving equipment is identical to the model RAS radio receiving equipment. All references to the model RAS equipment in this instruction book apply to the model RAS-2 equipment.

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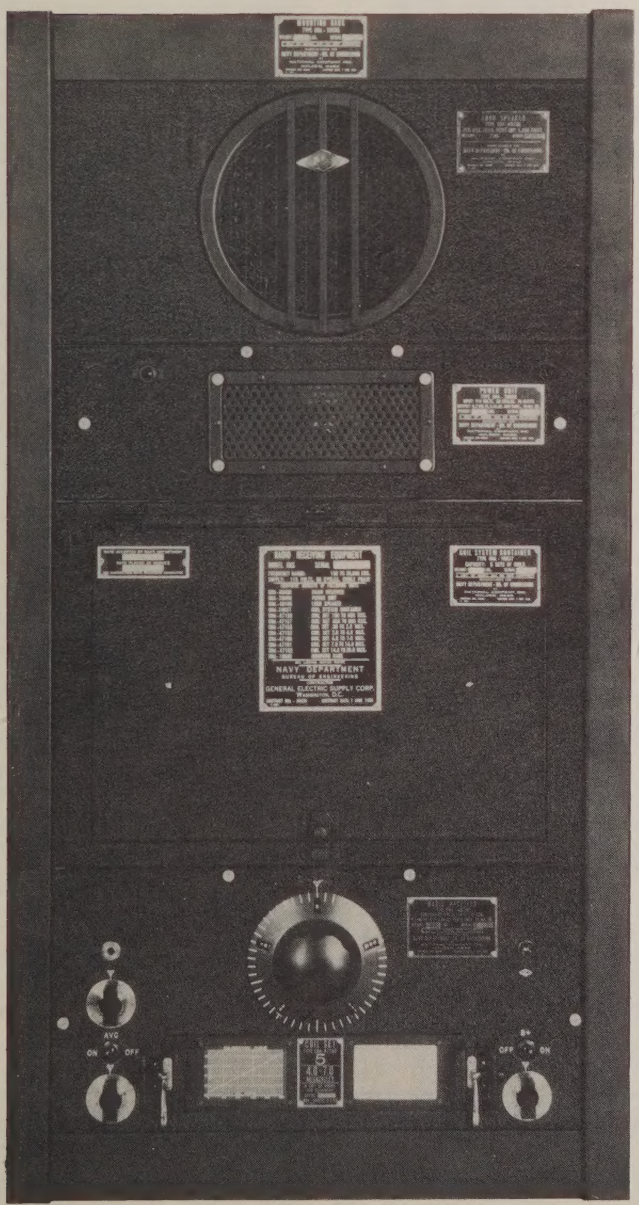


PHOTO NO. 1. MODEL RAS EQUIPMENT

Date of Acceptance by INM Boston, Mass.....

Date of Installation.....

Guaranteed 2 Years from Acceptance, 1 Year from Installation

## FAILURE REPORTS AND REPLACEMENT DATA

| Form N.Eng 183 | | Part Failing Symbol No. from Instruction Book | Date Replacement Received | Remarks |
|---|---|---|---|---|
| Date | Serial No. | | | |
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Reports of failures of Component Parts of the Model RAS Radio Receiving Equipment shall be made in accordance with Bureau of Engineering CIRCULAR LETTER 40b, dated January 16, 1939.

## 1. GENERAL DESCRIPTION

**1.1** The Model RAS Equipment is a complete radio receiving equipment suitable in all respects for use at Naval Radio shore stations or aboard Naval vessels.

**1.2** The equipments are suitable for the reception of radio telephone or telegraph signals (either CW or MCW) by either headphone or loud speaker methods.

**1.3** The equipments are of the self-supported rack mounted type with racks suitable for table mounting.

**1.4** The equipments are suitable for operation from 110/120 volts A.C., either 50/60 cycle or 25 cycle as may be designated on the name plate of the power unit.

**1.5** Each complete equipment consists of the following major items:

Type CNA-46080 — Radio Receiver
Type CNA-20090 — Power Unit
Type CNA-49105 — Loud Speaker
Type CNA-10037 — Coil System Container
Type CNA-10036 — Mounting Rack

Type CNA-49106 Loud Speaker replaces Type CNA-49105 Loud Speaker for table mounting.

Type CNA-20089 Power Unit replaces Type CNA-20090 Power Unit for 25 cycle operation.

The seven Coil Sets used with the Type CNA-46080 Radio Receiver are as follows:

Type CNA-47156—Coil Set 1—190 to 450 KC.—Band 1
Type CNA-47157—Coil Set 2—450 to 900 KC.—Band 2
Type CNA-47158—Coil Set 3—.90 to 2.0 MC.—Band 3
Type CNA-47159—Coil Set 4—2.0 to 4.0 MC.—Band 4
Type CNA-47160—Coil Set 5—4.0 to 7.0 MC.—Band 5
Type CNA-47161—Coil Set 6—7.0 to 14.0 MC.—Band 6
Type CNA-47162—Coil Set 7—14.0 to 30.0 MC.—Band 7

Instruction books and one set of spare parts are supplied in addition to the major items listed above.

**1.6** Net weights of all major items are listed in Par. 8.7. Overall dimensions are shown in Dwg. Nos. 16.01 to 16.07 inclusive.

## 2. DESCRIPTION OF MAJOR UNITS

**2.1** The Type CNA-46080 Radio Receiver is a nine tube, rack mounted superheterodyne covering a continuous frequency range of from 190 to 30,000 kilocycles.

**2.11** The circuit employed on all ranges comprises two stages of radio frequency amplification, first detector, high frequency oscillator, two stages of intermediate frequency amplification operating at 175 kilocycles, a bias type triode second detector and a resistance coupled audio output stage. The second detector tube utilizes one set of elements of a dual triode; the other set of elements is utilized for amplified and delayed automatic volume control. A beat frequency oscillator is coupled to the second detector to provide for CW reception.

**2.12** Two audio output circuits are provided:

(1) A phone jack is mounted on the front panel. The output from this jack is approximately 10 milliwatts of undistorted audio power. The correct load impedance for the phone output circuit is 600 ohms. The phone jack is supplied from the secondary of an audio output transformer, the center tap of the secondary being grounded to the chassis of the receiver. The jack is so wired that the loud speaker circuit is opened when the phone plug is inserted.

(2) Loud speaker terminals are provided at the rear of the receiver chassis. The undistorted audio power available at these terminals is nominally 2 watts. The correct load impedance for the speaker output circuit is 5000 ohms and the Types CNA-49105 and CNA-49106 Loud Speakers are fitted with coupling transformers correctly matching this value of impedance.

**2.13** Antenna input terminals are located at the left side of the chassis. The input circuit is suitable for operation with either a single wire antenna or a balanced feed line.

**2.14** The frequency range of 190 to 30,000 kilocycles is covered by seven plug-in coil sets as listed under Par. 1.5.

**2.2** The Type CNA-20090 Power Unit is built to supply all power required by the Radio Receiver. It is designed for operation from a power source of 110/120 volts 50/60 cycles.

The Type CNA-20089 Power Unit is similar to the CNA-20090 except that it is built for operation from a 110/120 volt 25 cycle power source.

Both Power Units employ a power transformer with primary fuses, vacuum tube rectifier, Navy Type-38593, and a one-section filter circuit. Normal D.C. output is 240 volts at 70 milliamperes for the receiver B supply; A.C. output is 6.2 volts at 3.4 amperes for the receiver heater circuits.

**2.3** The Type CNA-49105 Loud Speaker is a rack mounted dynamic speaker having an overall diameter of approximately eight inches. It is fitted with a 5000 ohm coupling transformer to match the receiver output, and voice coil impedances.

The Type CNA-49106 Loud Speaker is a table mounting dynamic speaker, having electrical characteristics identical with the Type CNA-49105 Loud Speaker.

**2.4** The Type CNA-10037 Coil System Container is an enclosed metal cabinet providing space for housing six plug-in coil sets.

**2.5** The Type CNA-10036 Mounting Rack is built to accommodate standard nineteen inch relay rack panels and has a total panel capacity of thirty-five inches. Side trim strips are provided to cover panel slots and mounting screws.

**2.6** The Coil Sets Types CNA-47156 to -47162, inclusive, are four-gang coil assemblies which plug into the Type CNA-46080 Radio Receiver. Seven Coil Sets are used to cover the 190 to 30,000 kilocycle frequency range, as listed under Par. 1.5.

## 3. TUBE COMPLEMENT

**3.1** The tubes employed in the Type CNA-46080 Radio Receiver are as follows:

| *Symbol (DWG)* | *Navy Type* | *Commercial Type* | *Function* |
|---|---|---|---|
| V-101 | —38646 | 6D6 | First R.F. Amplifier |
| V-102 | —38646 | 6D6 | Second R.F. Amplifier |
| V-103 | —38636 | 6C6 | First Detector |
| V-104 | —38636 | 6C6 | H.F. Oscillator |
| V-105 | —38646 | 6D6 | First I.F. Amplifier |
| V-106 | —38646 | 6D6 | Second I.F. Amplifier |
| V-107 | —38768F | 6F8G | Second Detector, AVC |
| V-108 | —38636 | 6C6 | C.W. Oscillator |
| V-109 | ..... | 6V6G° | Audio Amplifier |

° 6V6GT may be substituted

**3.2** The tube employed in the Type CNA-20089 or the Type CNA-20090 Power Unit is as shown below:

| *Symbol (DWG)* | *Navy Type* | *Commercial Type* | *Function* |
|---|---|---|---|
| V-201 | —38593 | 5Z3 | Rectifier (Full Wave) |

## 4. POWER REQUIREMENTS

**4.1** The Model RAS Radio Receiving Equipment is designed for operation from a 110/120 volt 50/60 or 25 cycle power source. Line current at 115 volts is .65 amperes. Normal power consumption is 70 watts.

**4.2** The Type CNA-46080 Radio Receiver is designed for operation with a B supply potential of 240 volts with a maximum current drain of 70 milliamperes. Normal heater voltage at the power cable plug is 6.2 volts A.C. Total heater current is approximately 3.4 amperes.

**4.3** The Types CNA-20089 and CNA-20090 Power Units deliver all necessary power for both plate and heater circuits, as specified under Par. 4.2.

**4.4** The Type CNA-46080 Radio Receiver may be operated from batteries. Best economy of battery power with minimum sacrifice in performance will be had with

180 volt B supply, at which voltage the current drain is 50 to 55 milliamperes. The heater supply may be a 6 volt storage battery.

## 5. ANTENNA REQUIREMENTS

**5.1** The input circuit of the Type CNA-46080 Radio Receiver is so arranged as to be suitable for use with either a balanced feed-line or a simple antenna-ground combination.

**5.2** The input impedance averages 500 ohms when using Coil Sets Types CNA-47159 to -47162, inclusive, having a total frequency range of from 1700 to 30,000 kilocycles. Coil Sets Types CNA-47156 to -47158, inclusive, have higher values of input impedance but in no case does the impedance exceed 5000 ohms.

**5.3** The antenna input terminals E-101 are located at the left-hand side of the receiver chassis when viewed from the front. Two insulated binding posts are provided together with a short length of flexible lead permanently attached to the receiver chassis which allows either input terminal to be grounded if required.

**5.4** In an installation having a simple antenna-ground combination, connect the single wire lead-in to either of the two input terminals, and ground the other terminal to the chassis by means of the flexible lead, referred to in Par. 5.3. It is recommended that the Mounting Rack of the Model RAS Equipment be permanently grounded but, if such an arrangement is impractical, the ground lead may be attached directly to the input terminal which is connected to the chassis. The dimensions of the single wire antenna system are not at all critical: the recommended minimum overall length of antenna and lead-in is fifty feet; the recommended maximum overall length is two hundred feet.

**5.5** In an installation having a balanced feed-line, connect the two leads directly to the two input terminals. The chassis grounding lead, referred to in Par. 5.3, is not used.

**5.6** In an installation having a concentric feed-line, connect the inner conductor to one of the terminals and the outer conductor to the other input terminal. Connect the latter to the chassis by means of the flexible lead.

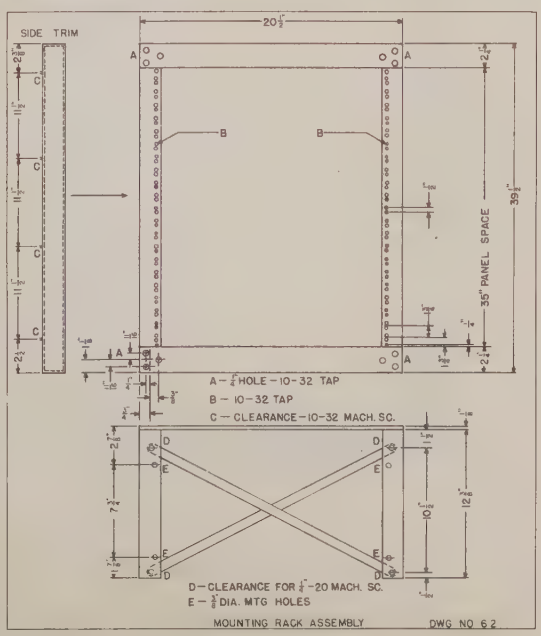
## 6. INSTALLATION

**6.1** The Model RAS Radio Receiving Equipment is shipped unassembled, each major unit being packed in a separate container. Spare Parts, including spare tubes, are packed separately.

**6.2** After unpacking all units, assemble the Type CNA-10036 Mounting Rack; after assembly, it may be permanently installed in the operating position. Dwg. No. 6.2 supplies complete data covering the construction and assembly of the Mounting Rack.

**6.3** Assemble each of the associated major units in the Mounting Rack, as shown in Dwg. No. 16.01. Machine screws are supplied with each major item for fastening the front panels to the side members of the Mounting Rack. Side trim strips, which cover the panel slots and mounting screws, complete the assembly.

**6.4** Make interconnections between major items of the equipment shown in Dwg.


SIDE TRIM
20½
35" PANEL SPACE
39½
A – ¼ HOLE – 10-32 TAP
B – 10-32 TAP
C – CLEARANCE – 10-32 MACH. SC.
D – CLEARANCE FOR ¼"-20 MACH. SC.
E – ⅜ DIA. MTG HOLES
MOUNTING RACK ASSEMBLY
DWG NO 6.2

No. 16.08 as follows: Insert the cable plug P-101 of the Type CNA-46080 Radio Receiver in the output socket J-202 of the Type CNA-20089 or CNA-20090 Power Unit and fasten the shield grounding lug of cable W-101 under the thumb screw E-201 nearest the socket J-202. Connect the shielded leads of the Type CNA-49105 or Type CNA-49106 Loud Speaker to the speaker terminals E-107 of the Receiver; screw the shield grounding lug of cable W-301 to the chassis terminal E-108.

**6.5** Insert plug P-202 in socket J-201 of the Type CNA-20089 or CNA-20090 Power Unit. Make connection to the proper 110/120 volt A.C. source by means of connector cord W-201 and plug P-201.

**6.6** Make antenna connections in accordance with Section 5, Antenna Requirements.

**6.7** The radio frequency upon which reception is desired will determine the Coil Set to employ, in accordance with the FREQUENCY CALIBRATION curves, Dwg. No. 11.7, or in accordance with the individual charts on each coil set panel. Select the proper Coil Set, and plug it into the opening in the front of the radio receiver, with the latch handles in the upper position. After the coil set has been pushed in as far as it will go, clamp it in place by swinging the latch handles to the extreme lower position.

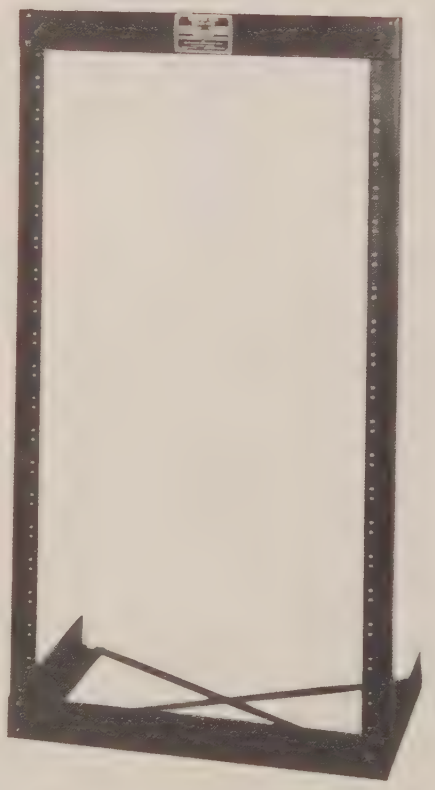


PHOTO NO. 6.2

MOUNTING RACK

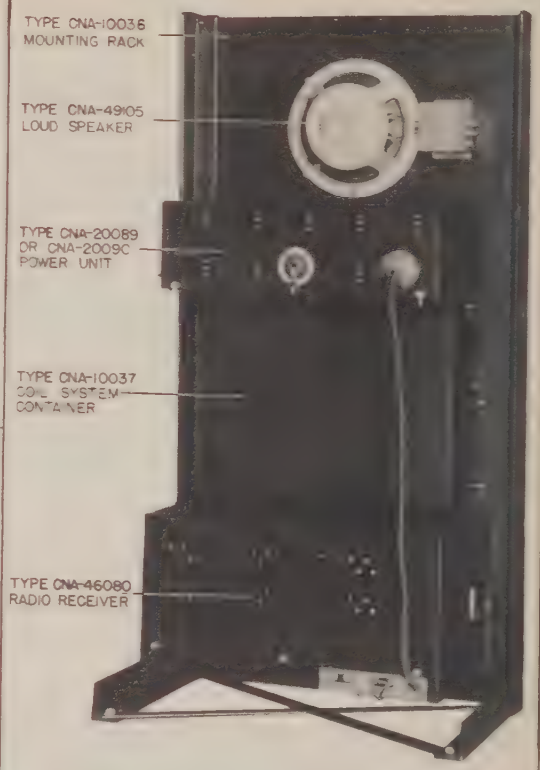



PHOTO NO. 6.3

REAR VIEW OF MODEL RAS EQUIPMENT

**6.8** The Equipment is now ready for operation and is turned on by means of a toggle switch S-201 on the front of the Power Unit.

**6.9** A pair of terminals E-106 at the rear of the receiver chassis is wired to the B+ switch S-103. These terminals provide a convenient means of connecting a relay or switch for remote control.

## 7. TUBE LOCATION BY NAVY TYPE

**7.1** The following table lists all tubes of the Model RAS Equipment by Navy Type Numbers.

| *Navy Type* | *Commercial Type* | *Function* | *Symbol (DWG)* |
|---|---|---|---|
| —38593 | 5Z3 | Rectifier | V-201 |
| —38636 | 6C6 | First Detector | V-103 |
| —38636 | 6C6 | H.F. Oscillator | V-104 |
| —38636 | 6C6 | C.W. Oscillator | V-108 |
| —38646 | 6D6 | First R.F. Amplifier | V-101 |
| —38646 | 6D6 | Second R.F. Amplifier | V-102 |
| —38646 | 6D6 | First I.F. Amplifier | V-105 |
| —38646 | 6D6 | Second I.F. Amplifier | V-106 |
| —38768F | 6F8G | Second Detector, AVC | V-107 |
| ..... | 6V6G° | Audio Amplifier | V-109 |

° 6V6GT may be substituted

## 8. CONSTRUCTION

### 8.1 GENERAL

**8.11** All items of the Model RAS Radio Receiving Equipment are ruggedly constructed of the best material known to be suitable for each specific employment.

**8.12** All materials entering into its construction are, insofar as is practicable, resistant to the corrosive action of moist sea atmosphere or are suitably protected therefrom.

**8.13** All soldered joints are secure and are covered with a colored lacquer which protects exposed metal parts of the joints from corrosion. Rosin flux is used exclusively for soldering.

**8.14** All steel chassis, dust covers, cabinets and similar steel parts are copper-plated underneath a baked enamel finish so that the steel will be protected against corrosion should the painted surface become injured.

**8.15** Provision for ventilation is made by the use of ventilating holes and louvres.

**8.16** All major parts and spare parts are interchangeable without modification with similar parts employed in the construction of other equipments and are suitably marked to permit identification for ordering purposes.

**8.17** Stainless steel lock washers are used on all steel screw heads and nuts. Bronze lock washers are used under brass nuts or between brass and ceramic surfaces.

**8.18** All wiring is color coded in order to facilitate testing and the location of faults. Flexible wire is rubber covered with an overall silk braid.

**8.19** Front panels of all component units have a Navy Standard black wrinkle finish. Dust shields and other exposed metal parts are finished with flat black enamel.

### 8.2 THE TYPE CNA-46080 RADIO RECEIVER

**8.201** The Receiver is designed for relay rack mounting, the chassis and all component parts being supported by the front panel. See Photos Nos. 17.02 and 17.18.

**8.202** The sides, top and back of the receiver are protected by a steel dust cover which is attached to the front panel by knurled thumb screws. The bottom of the chassis is fitted with a steel cover plate held in place by machine screws. The dust cover may be removed without taking the Receiver out of the mounting rack. The Receiver must be removed from the rack in order to detach the bottom plate.

**8.203** The Receiver panel layout is shown in Photo No. 17.01. The locations and functions of the various controls are described in Sec. 10, Operating Instructions.

**8.204** Any one of seven tuning ranges may be selected by inserting the proper plug-in Coil Set into a compartment in the receiver chassis through a rectangular opening in the front panel. The Coil Set in use may be "dogged" in place by means of eccentric latches located at either side of the panel

opening. Both receiver and Coil Sets are fitted with handles to facilitate band changing.

**8.205** Each plug-in Coil Set comprises four shielded tuning inductors and their associated padding capacitors and air-dielectric trimmer capacitors. Low loss phenolic or polystyrene forms are employed to support all radio frequency coils. The general construction of a complete Coil Set is shown in Photo No. 17.09. The internal construction of R.F. transformer units is shown in Photos Nos. 17.10 to 17.16 inclusive.

**8.206** Each inductor unit of each coil set has five coin silver contact buttons which engage with silver surfaced spring contact fingers mounted on the receiver chassis.

**8.207** The main tuning capacitor is of the four gang in line type with 180° rotation for maximum capacitance change. Stator plates are supported by Isolantite insulators. Contact to the rotors is made by means of spring fingers carrying coin silver contact buttons which make sliding contact with coin silver collector rings welded to the ends of the individual rotor plate assemblies.

**8.208** The main tuning capacitors are driven by a worm, the shaft of which carries the main tuning dial. This worm engages a split spring loaded worm gear, the step-down ratio of the combination being 20:1. The tuning dial is marked with 50 divisions spaced approximately ¼ of an inch apart. This dial makes ten complete revolutions in turning the tuning capacitors through 180°. A system of epicyclic gearing changes the dial scale numbering so that the correct numbers for every ten dial divisions appear progressively as the dial is rotated. The numbers are framed by small windows in the dial face so that only the correct numbers are visible at any time. This system of indexing provides a dial which is direct reading to 1 division in 500 with a maximum readable accuracy of 1 part in 2500.

**8.209** The intermediate frequency transformers have conventional tuned primaries and tuned secondaries. Tuning capacitors are of air-dielectric construction and are mounted on ceramic bases. Primary and secondary inductors are "universal" wound on ceramic cores. The internal construction of a typical I.F. transformer is shown in Photo No. 8.209.

**8.210** All tube sockets are of ceramic construction.

PHOTO NO. 8.209

TYPICAL I.F. TRANSFORMER ASSEMBLY

**8.211** All component parts which may require removal in the event of damage to or failure of the receiver are mounted with machine screws and are fitted with terminal panels (if required) to facilitate replacement.

**8.212** Pressure contact joints in R.F. and I.F. circuits have been eliminated insofar as is practicable. To this end, screws, studs, nuts, etc., carrying R.F. currents are soldered to provide a completely bonded metallic circuit. Soldered connections in R.F. inductor units and I.F. transformers are coated with polystyrene lacquer.

**8.213** With one exception (C-110) all fixed capacitors of less than .01 mfd. are of molded mica construction. Capacitors of .01 mfd. or larger are of the metal cased hermetically sealed oil impregnated type.

**8.214** All fixed resistors, except R-139, have a ceramic body fused to a central carbon resistance element. They are

marked with the R.M.A. color code. Resistor R-139 is wire wound on a fiber form.

**8.215** The headphone coupling transformer is vacuum wax impregnated and sealed in a metal container with high melting point compound.

### 8.3 TYPES CNA-20089 AND CNA-20090 POWER UNITS

**8.31** The construction of these Power Units is identical except for the power transformers. Provision is made on all chassis to mount either the 25 cycle or 50/60 cycle transformer.

**8.32** The chassis and all component parts are supported by a steel rack mounting panel, as shown in Photo No. 17.04.

**8.33** Sides, top and back of the power unit are protected by a ventilated dust shield. The dust shield is held in place by knurled thumb screws and may be removed without taking the power unit out of the mounting rack.

**8.34** Access to the rectifier tube and line fuses is provided by an opening in the front panel. This opening is normally covered by a metal grille work attached to the panel by four knurled thumb screws.

**8.35** A recessed male connector for AC power input is mounted at the rear of the chassis. B supply and 6.2 volt heater supply circuits terminate at a four prong socket at the rear of the chassis. Both input and output terminals are accessible through openings in the dust shield.

**8.36** The power transformer and filter reactor are mounted in individual cases. They are protected from the effects of humidity by a moisture resistant compound which seals each case. All leads of the power transformer and filter reactor are brought to soldering lugs on terminal panels permanently attached to the respective cases.

**8.37** All component parts are attached to the chassis by machine screws or nuts for ease of removal in servicing.

### 8.4 TYPE CNA-49105 LOUD SPEAKER

**8.41** The Loud Speaker is of the dynamic cone type mounted on a rack panel. Construction is shown in Photos Nos. 17.05 and 17.06. The nominal diameter of the loud speaker proper is 8 inches.

**8.42** The panel is provided with a 6¾ inch hole in front of the speaker cone which is protected by a heavy metal grille.

**8.43** An impedance matching transformer, "potted" in a metal case, is attached to the rear of the speaker panel. It is fitted with terminal panels which carry soldering lugs.

**8.44** A two-wire shielded cable is permanently attached to the coupling transformer and provides for connection to the speaker output terminals of the CNA-46080 Radio Receiver.

**8.45** A cabinet type Loud Speaker, Type CNA-49106, for table mounting may be furnished, in some cases, as an auxiliary unit of the model RAS Equipment. Cabinet dimensions are shown in Dwg. No. 16.04. The loud speaker chassis and matching transformer are identical with those of the Type CNA-49105 Loud Speaker. See Photo Nos. 17.19 and 17.20.

### 8.5 THE TYPE CNA-10037 COIL SYSTEM CONTAINER

**8.51** The Coil System Container is a rack mounted cabinet having six rectangular compartments for housing unused Coil Sets. See Photo Nos. 17.07 and 17.08.

**8.52** The compartments are accessible through a rectangular opening in the panel. This opening is provided with a door hinged at the upper edge. The door must be opened through an angle of approximately 90° to allow removal or insertion of Coil Sets. A catch is provided to hold the door in the open position. A spring latch is provided to hold the door closed.

**8.53** Coil Sets are housed in the compartments with their name-plates toward the front so that the complete front panels of all coil sets are visible when the door is open.

**8.54** A padded cross-piece is attached to the inside of the door and serves to hold the Coil Sets firmly in place in the compartments when the door is closed.

### 8.6 THE TYPE CNA-10036 MOUNTING RACK

**8.61** The Mounting Rack is constructed with 1½" x 2" angle iron side pieces and footing, with cross-pieces at both top and bottom. This construction is shown in Photo No. 6.2.

**8.62** The Mounting Rack is built to accommodate standard 19 inch relay rack panels and has a total panel capacity of 35 inches. Side trim strips are provided to cover panel slots and mounting screws.

**8.63** Both side members have 10/32 tapped holes for mounting the major items of the equipment. These holes have the standard spacing of ½ inch and 1¼ inch on centers, alternately.

### 8.7 NET WEIGHTS

Type CNA-46080 Radio Receiver (with one coil set) .....35 lbs.
Type CNA-20090 Power Unit ....22 lbs.
Type CNA-49105 Loud Speaker....9 lbs.
Type CNA-10037 Coil System Container (Including Six Coil Sets) .....26 lbs.
Type CNA-10036 Mounting Rack .....27 lbs.
Type CNA-20089 Power Unit ....27 lbs.
Type CNA-49106 Loud Speaker..11 lbs.
Spare Parts (cased) for Equipments with Type —20090 Power Unit .....21 lbs.
Spare Parts (cased) for Equipments with Type —20089 Power Unit .....26 lbs.
Total Weight of Equipment, including Spare Parts, with Type —20090 Power Unit .....140 lbs.
Total Weight of Equipment, including Spare Parts, with Type —20089 Power Unit .....150 lbs.

## 9. CIRCUIT DESCRIPTION

### 9.1 TYPE CNA-46080 RADIO RECEIVER

**9.11** The actual wiring diagram of the Type CNA-46080 Radio Receiver is shown in Dwg. No. 16.10.

The actual wiring diagram of the seven Coil Sets Types CNA-47156 to CNA-47162, inclusive, are shown in Dwg. Nos. 16.13 to 16.19 inclusive.

For purposes of illustration, it will be assumed that Coil Set Type CNA-47156 is in use, symbol numbers of circuit elements in the Coil Set will, therefore, refer to Dwg. No. 16.13.

**9.12** Signal input to the receiver through terminals E-101 is connected to the first R.F. amplifier transformer assembly T-401 by contactor strip E-102. Transformer L-401 is tuned by trimmer capacitor C-401 and by the first R.F. section C-101A of the main tuning capacitor C-101. The output of transformer L-401 is connected to the grid of the first R.F. amplifier tube V-101. The plate circuit of V-101 is connected through contactor strip E-103 to the second R.F. transformer assembly T-402. Transformer secondary L-403 is tuned by trimmer capacitor C-402 and by the second R.F. section C-101B of the main tuning capacitor C-101. The output of the second R. F. transformer is connected to the grid of the second R.F. amplifier tube V-102. Minimum bias for V-101 and V-102 is furnished by cathode resistors R-102 and R-104 respectively. The plate of V-102 is connected by contactor strip E-104 to the first detector transformer assembly T-403. Transformer L-404 is tuned by trimmer capacitor C-403 and by the first detector section C-101C of the main tuning capacitor C-101. The output of transformer L-404 is connected to the grid of the first detector tube V-103.

**9.13** The H.F. oscillator circuit is of the so-called "electron coupled" type. The H.F. oscillator inductor L-405 is tuned by trimmer capacitor C-404 and by the H.F. oscillator section C-101D of the main tuning capacitor C-101 with parallel connected capacitors C-405 and C-406 in series. The latter capacitors are known as series padding or "lag" capacitors and are used to modify the tuning of the H.F. oscillator circuit so that it will maintain a fixed frequency difference of 175 kilocycles with the signal frequency circuits when the main tuning capacitor C-101 is varied from minimum to maximum capacity. H.F. oscillator potential obtained from the cathode of tube V-104 is coupled by means of capacitor C-110 to the screen grid of first detector tube V-103.

**9.14** The plate voltage on first detector tube V-103 is normal (approximately 180 volts) but the screen voltage is considerably lower than the value applied in an amplifier application. The voltage reduction is obtained through the combination of resistors R-107, R-108 and R-109. Bias on the first detector tube V-103 is obtained from cathode resistor R-110 and is considerably higher than the value applied in an amplifier application. The combination of low screen voltage and high bias causes tube V-103 to operate on a non-linear portion of its grid-voltage-plate-current characteristic, with the result that R.F. signal voltage, applied to the control grid, heterodynes with the high frequency oscillator potential applied to the screen grid, producing a third R.F. potential the frequency of which is equal to the difference between signal and oscillator frequencies. This third frequency is the intermediate frequency of the receiver, i.e., 175 kilocycles.

**9.15** I.F. potential from the first detector tube V-103 is coupled by I.F. transformer T-101 to the first I.F. amplifier tube V-105. I.F. transformer T-102 couples V-105 to the second I.F. amplifier tube V-106. I.F. transformer T-104 couples V-106 to the second detector tube V-107A. Minimum bias for V-105 and V-106 is furnished by cathode resistors R-114 and R-125 respectively. I.F. transformers T-101, T-102 and T-104 each employ tuned primaries and tuned secondaries. The characteristics of these transformers determine the minimum selectivity of the

receiver as a whole. The selectivity of the R.F. and first detector transformers has some effect upon the overall selectivity characteristic, however, tending to decrease band width. Coil Sets Types CNA-47156 and CNA-47157, covering frequencies from 190 to 900 kilocycles, produce a noticeable narrowing of the overall selectivity characteristic as shown in Dwg. No. 11.3. Coil Sets Types CNA-47158 to CNA-47162, inclusive, do not contribute appreciably to the overall selectivity of the receiver.

**9.16** The elements of the second detector tube V-107A are those of one triode of a dual triode tube type —38768F. The second detector is the biased triode type wherein the grid is biased close to cut-off by the voltage drop across resistor R-132. Upon reaching the second detector, the I.F. signal is demodulated, the modulation components passing on to the audio amplifier V-109. Resistor R-135 and capacitors C-135 and C-137 comprise a filter circuit which suppresses the 175 kilocycle component of the second detector output but allows modulation components to pass.

**9.17** Associated with the second detector circuits is the CW oscillator tube V-108. The CW oscillator circuit normally operates at the 175 kilocycle intermediate frequency. It provides an R.F. potential with which an unmodulated I.F. signal at the second detector can heterodyne to produce an audible CW beat note. The frequency of the CW oscillator is determined by transformer T-103; the circuit is the "electron coupled" type. Two capacitors C-144 and C-145, in parallel, provide adequate capacity to make the frequency of the CW oscillator stable. The frequency of the CW oscillator circuit is adjustable within narrow limits by variable capacitor C-126 which is fitted with a panel control. This capacitor is connected between the cathode tap and the low potential end of T-103. This connection simplifies shielding and allows the use of a comparatively large variable capacitor to provide a small tuning change. CW oscillator potential from the plate of tube V-108 is coupled by means of capacitor C-128 to the grid of the second detector tube V-107A. For most efficient heterodyne action, the peak CW oscillator R.F. potential impressed upon the grid of V-107A should approach but not exceed the D.C. grid bias.

**9.18** Automatic volume control action is provided by tube V-107B. The elements of V-107B are those of one triode of the dual triode type -38768F. A.V.C. tube V-107B is biased beyond cut-off by means of resistors R-129, R-130 and R-131. These resistors are connected between the receiver chassis and B minus and carry the total B current drawn by the receiver, with the exception of the current drawn by audio tube V-109. Inasmuch as the plate current flow in A.V.C. tube V-107B is limited by plate resistor R-127 to a fraction of a milliampere, the resistor network R-129, R-130 and R-131 provides essentially constant bias. The action of the A.V.C. circuit is as follows: I.F. signal potential from the output of transformer T-104 is impressed upon the grid of A.V.C. tube V-107B through the coupling capacitor C-140. As previously stated, the A.V.C. tube is biased beyond cut-off, but when sufficiently strong I.F. signal voltage peaks are impressed upon the grid plate current will flow through resistor R-127. The voltage drop across resistor R-127 is connected through common filter resistor R-126 to the control grids of tubes V-101, V-102, V-105 and V-106 through filter resistors R-101, R-103, R-112 and R123, respectively. This voltage increases the bias on the grids of the four tubes mentioned above with the result that amplification in both R.F. and I.F. amplifiers is reduced, thus maintaining an essentially constant I.F. signal at the grid of the second detector V-107A. Since the plate current flow in A.V.C. tube V-107B tends to vary with the peaks of the I.F. signal voltage, capacitor C-130 is used to filter out voltage fluctuations which, if fed back to the R.F. and I.F. tubes, would produce distortion and oscillation. Capacitors C-102, C-103, C-107, C-117 and C-123 provide additional filtering and circuit isolation, at the same time completing R.F. ground returns for the various transformers to which they are connected.

As previously stated, resistors R-129, R-130 and R-131 bias A.V.C. tube V-107B beyond cut-off. The value of bias voltage determines the threshold level at which A.V.C. action starts and the difference between this bias voltage and the cut-off bias of A.V.C. tube V-107B is termed the "delay voltage". In order that the second detector tube V-107A may deliver an adequate signal to the audio amplifier before the A.V.C. limiting action starts, resistors R-129, R-130 and R-131 are chosen to produce a delay voltage of approximately 4 volts DC.

The output of the CW oscillator tube V-108 is necessarily coupled to the grids of both second detector and A.V.C. tubes; consequently, considerable A.V.C. voltage is developed when the CW oscillator is turned on. Under such conditions, the Receiver will be extremely insensitive and for this reason the A.V.C. switch S-102 must be turned off whenever the CW oscillator is used for CW reception.

**9.19** The audio output tube V-109 supplies audio power to both headphone and loud speaker terminals, J-101 and E-107, respectively. The speaker terminals are connected directly in the plate circuit while the headphone jack is coupled to the plate circuit by transformer T-105. The headphone jack J-101 is so wired that the loud speaker terminals E-107 are disconnected and the phone output transformer T-105 with resistor R-138 are substituted when a headphone plug is inserted in the jack. Transformer T-105 has a turns ratio of 1:1, the necessary reduction in power for headphone operation being obtained by the use of resistor R-138, which constitutes a low impedance load for the audio output tube V-109.

### 9.2 TYPES CNA-20089 AND CNA-20090 POWER UNITS

**9.21** The actual wiring diagrams of the Types CNA-20089 and CNA-20090 Power Units are shown in Dwg. No. 16.11. Inasmuch as the two Power Units are identical, except for power transformers, the following material will be applicable to either.

**9.22** A.C. power input is supplied through plug P-201, cable W-201 and plug P-202 to connector J-201 of the Power Unit. The primary circuit of the power transformer T-201 is fused with two one-ampere fuses F-201 and F-202, one fuse being connected in each side of the circuit. These fuses provide adequate protection to the power transformer T-201 and the rectifier tube V-201 in the event of failure of any component in the equipment which might impose a heavy overload upon the Power Unit.

**9.23** Radio frequency signals or disturbances which might be picked up by the power source wiring or by cable W-201 are prevented from reaching the Radio Receiver by means of filter capacitors C-201 and C-202. The power transformer T-201 is built with an electrostatic shield between the primary and secondary windings to further attenuate such undesired voltages. Capacitor C-201 is connected between one side of the primary and the chassis of the power unit. In the event that the power supply lines have one side grounded, a small A.C. current may flow through capacitor C-201 producing a visible spark when the Power Unit or the RAS Equipment, as a whole, is connected to ground. The current through capacitor C-201 will not exceed .5 milliamperes, so that there is no possibility of a dangerous shock to any of the operating personnel.

**9.24** The circuit arrangement, wiring and operation of the Power Unit is conventional. It should be noted, however, that neither side of the B supply circuit is connected to the chassis. It is necessary, therefore, to provide a direct, low resistance connection between the chassis of the power unit and the chassis of the radio receiver, in order that both may be at ground potential. This connection is made by means of the shield of cable W-101 of the Radio Receiver which is connected to terminal E-201 of the power unit.

### 9.3 TYPES CNA-49105 AND CNA-49106 LOUD SPEAKERS

**9.31** The actual wiring diagrams of the CNA-49105 and CNA-49106 Loud Speakers are shown in Dwg. No. 16.12. The two Loud Speakers are identical, electrically.

**9.32** Connection between the speaker output terminals E-107 of the Radio Receiver and the Loud Speaker is made by shielded cable W-301. The cable shield is connected to terminal E-108 and provides a bond between the loud speaker chassis and the chassis of the Radio Receiver, thus maintaining them at ground potential.

### 9.4 COIL SETS TYPES CNA-47156 TO CNA-47162 INCLUSIVE

**9.41** While the construction and operation of all Coil Sets of the Model RAS Equipment are similar, individual components of the various Coil Sets differ considerably. These differences are required to maintain the overall characteristics of the RAS Equipment as nearly uniform as practicable over the frequency range of 190 to 30,000 kilocycles.

**9.42** The actual wiring diagram of Type CNA-47156 Coil Set is shown in Dwg. No. 16.13.

**9.421** Trimmer capacitors C-401, C-402, C-403 and C-404 are used to adjust the minimum capacities of the tuned circuits to which they are connected, serving to compensate for unavoidable variations in wiring and tube capacities.

**9.422** R.F. transformer assembly T-401 has a low inductance primary winding loosely coupled to a tuned secondary to provide the proper input impedance for conventional antenna systems operating in the frequency range of the Coil Set.

**9.423** The second R.F. amplifier transformer assembly T-402 is built to provide maximum amplification at the low frequency end of the Coil Set tuning range. This is accomplished by so proportioning primary L-402 that the primary circuit, as a whole, resonates broadly at a frequency outside the low frequency limit of the Coil Set tuning range. The primary circuit will, therefore, show increasing impedance as the receiver

is tuned to signals of lower frequency. The impedance of the R.F. tuned circuit decreases as the L/C ratio decreases, thus tending to reduce stage gain as the low frequency end of the tuning range is approached. The resonant characteristic of the primary described above increases gain at low frequencies, overcompensating for the lowering impedance of the secondary. In order to obtain the proper amount of compensation, a small coupling capacity is provided between terminals 1 and 5 of the transformer. This capacity is in the order of 1 or 2 mmf. and is obtained by utilizing the capacity between coil leads, stray wiring capacity, etc.

**9.424** The first detector transformer assembly T-403 has a low inductance primary and, in consequence, stage gain is maximum at the high frequency end of the coil set tuning range. The use of a high inductance resonant primary is undesirable in this portion of the circuit since it tends to cause feedback in the I.F. amplifier. Its use is not required as the second R.F. amplifier transformer furnishes adequate gain compensation.

**9.425** The operating principles of the H.F. oscillator were discussed under Par. 9.13. It will be noted that capacitors C-405 and C-406 are connected in parallel. Actually, capacitor C-405 is used as a vernier adjustment for capacitor C-406 since the net capacity of the two is critical and must be adjusted with a high degree of precision.

**9.43** The actual wiring diagram of the Type CNA-47157 Coil Set is shown in Dwg. No. 16.14. The operating principles of all circuit components are similar to those of the Type CNA-47156 Coil Set, described under Par. 9.42.

**9.44** The actual wiring diagram of the Type CNA-47158 Coil Set is shown in Dwg. No. 16.15. The operating principles of all circuit components are similar to those of the Type CNA-47156 Coil Set, described under Par. 9.42.

**9.45** The actual wiring diagram of the Type CNA-47159 Coil Set is shown in Dwg. No. 16.16. The operating principles of all circuit components are similar to those of the Type CNA-47156 Coil Set, as described under Par. 9.42, with the exception of the first detector transformer T-703 which uses a high inductance primary L-704. Gain compensation in R.F. transformer assemblies T-702 and T-703 is arranged to produce essentially uniform amplification in each over the tuning range of the coil set. A single series padding capacitor C-705 is used in the H.F. oscillator transformer assembly T-704, no vernier adjustment being required.

**9.46** The actual wiring diagram of the Type CNA-47160 Coil Set is shown in Dwg. No. 16.17. The operating principles of all circuit components are similar to those of the Type CNA-47159 Coil Set, as described under Par. 9.45.

**9.47** The actual wiring diagram of Type CNA-47161 Coil Set is shown in Dwg. No. 16.18. The operating principles of all circuit components are similar to those of the Type CNA-47156 Coil Set, described under Par. 9.42. A single series padding capacitor C-905 is used in the H.F. oscillator transformer assembly T-904, no vernier adjustment being required.

**9.48** The actual wiring diagram of the Type CNA-47162 Coil Set is shown in Dwg. No. 16.19.

**9.481** Trimmer capacitors C-1001, C-1004, C-1005 and C-1006 are used to adjust minimum circuit capacity, as explained under Par. 9.421.

**9.482** The first R.F. amplifier transformer T-1001 of the Type CNA-47162 Coil Set differs from those previously described in two respects:

(1) Series capacitor C-1003 is connected in the antenna primary circuit and serves to reduce the detuning effect of the antenna upon the secondary tuned circuit.

(2) A series padding capacitor C-1002 is connected between transformer terminals 1 and 2 and serves to modify the effective capacity range of the first R.F. section C-101A of the main tuning capacitor C-101. Such modification is required to provide accurate tracking of the first R.F. amplifier, second R.F. amplifier and first detector tuned circuits.

**9.483** The second R.F. amplifier transformer T-1002 has three windings all closely coupled together. The primary winding connected in the plate circuit of the first R.F. tube V-101 is interwound with the tuned secondary winding and both have approximately the same number of turns. A third winding which feeds the control grid of the second R.F. amplifier tube V-102 is so proportioned that its natural period (or resonant frequency) falls just outside the low frequency end of the frequency range covered by the coil set. The impedance of this resonant secondary increases as the low frequency end of the tuning range is approached, thus tending to compensate for the unfavorable L/C ratio of the tuned secondary in much the same manner as explained under Par. 9.423. The resonant secondary arrangement is preferable to the resonant

primary, previously described, in the 14-30 megacycle range. Its use renders the tuned circuit more efficient by reducing the damping effect of high grid conductance which is characteristic of the Type -38646 tube in this frequency range.

The reactance of the resonant secondary varies considerably over the tuning range of the coil set and since it is closely coupled to the tuned circuit, the normal tuning range is altered exactly as if a padding capacity were connected in series with the second R.F. amplifier section C-101B of the main tuning capacitor C-101. It is for this reason that capacitor C-1002 is required in the first R.F. amplifier transformer assembly T-1001, as mentioned under Par. 9.482.

**9.484** The operating principles of the first detector transformer L-1002 are similar to those of the second R.F. amplifier transformer L-1002 described under Par. 9.483.

**9.485** The operating principles of the H.F. oscillator transformer assembly T-1004 are similar to those described under Par. 9.425 except that the series padding capacitor C-1007 has less capacity than that which would normally be required, because of the modified tuning characteristics of the first R.F. amplifier, second R.F. amplifier and first detector transformers, as mentioned in Par. 9.482, 9.483 and 9.484.

## 10. OPERATING INSTRUCTIONS

### 10.1 CONTROLS

**10.101** All switches and controls (with the exception of the main tuning dial) of the Type CNA-46080 Radio Receiver are identified by panel engraving or by etched dial scales. The A.C. supply switch of the Type CNA-20090 Power Unit (and Type CNA-20089 Power Unit) is identified by an "ON-OFF" plate.

**10.102** The main tuning dial N-101 is located at the center of the front panel of the Type CNA-46080 Radio Receiver. As previously described, this dial drives the four-gang tuning capacitor C-101. The dial drive is so arranged that the frequency to which the receiver tunes increases as the dial reading increases. See Dwg. No. 11.7. Each Coil Set is fitted with a calibration chart showing the relationship between dial reading and frequency.

**10.103** The R.F. GAIN control N-102 (R-115) is located at the lower right-hand corner of the receiver front panel and serves to adjust the amplification of the second R.F., first and second I.F. stages. Maximum sensitivity is obtained by rotating the control knob to the extreme clockwise position, 10. In this position all tubes are operating at maximum gain with minimum bias. As the control is turned counterclockwise, increasing bias is applied to the second R.F. tube V-102, first I.F. tube V-105 and second I.F. tube V-106, thus reducing their amplification.

**10.104** Directly above the R.F. GAIN control is a two-position toggle switch S-103. In the B+ OFF position, the positive lead of the power supply circuit is opened and the receiver is inoperative. In the B+ ON position, the power supply circuits are complete.

**10.105** A pilot light I-101 is illuminated when the tube heater circuits are supplied with power from the Power Unit.

**10.106** The C.W. OSC. control knob N-103 (C-126, S-101), located at the lower left side of the front panel, controls the CW oscillator. In the OFF position, B power is disconnected from both plate and screen circuits of the CW oscillator tube V-108. Rotating the knob in a clockwise direction throws a switch S-101 that connects B voltage to the plate and screen circuits. Further rotation of the knob from O on the scale to 10 varies the frequency of the CW oscillator over a range of approximately 10 kc. by means of capacitor C-126. The CW oscillator tunes to the intermediate frequency, 175 kc., at 9 on the scale.

**10.107** Above the C.W. OSC. knob is the A.V.C. switch S-102. In the OFF position the automatic volume control is inoperative while in the ON position, the automatic volume control circuit functions normally.

**10.108** At the left hand side of the panel, above the A.V.C. switch, is the A.F. GAIN control knob N-104. This knob is attached to pontentiometer R-136 in the grid circuit of the output amplifier tube V-109 and is used to adjust the audio signal voltage applied to the control grid.

**10.109** A terminal panel E-106, marked "BSW", is mounted at the rear of the receiver chassis. Two terminals are provided which are connected in parallel with the B+ switch S-103. These terminals provide a convenient means for remote control of the equipment by employing a suitable relay or switch.

**10.110** The Types CNA-20089 and CNA-20090 Power Units are each fitted with a toggle switch S-201 for controlling the primary A.C. power circuit.

### 10.2 MCW RECEPTION

**10.21** After the Model RAS Equipment is properly installed as specified in Section 6, Installation, it is put into operation by turning the Power Unit switch S-201 ON and the Receiver B+ switch S-103 ON. The C.W. OSC. control must be turned OFF. The A.V.C. switch S-102 may be in either the ON or OFF position. The Equipment is now adjusted for MCW reception and will tune in accordance with the frequency calibration of the Coil Set in use.

**10.22** With A.V.C. OFF, the setting of the A.F. GAIN and R.F. GAIN controls will depend to some extent upon operating conditions. It is recommended that the A.F. GAIN control be set at about 5 and the R.F. GAIN control advanced as may be required to provide a satisfactory audio signal. When receiving weak signals, best signal-to-noise ratio will be obtained by retarding the A.F. GAIN control and advancing the R.F. GAIN control to a point as near maximum as receiving conditions permit. The operator must be careful to avoid overloading the I.F. or second detector stages under these conditions. Overload will be indicated by excessive audio distortion.

**10.23** To receive MCW signals with automatic volume control, the A.V.C. switch must be in the ON position. The R.F. GAIN control should be advanced to a point as near maximum as receiving conditions permit. Audio output should be controlled entirely by means of the A.F. GAIN control. When the noise level is so high that it is found impractical to fully advance the R.F. GAIN control, the control may be retarded to limit the overall sensitivity of the receiver to a definite maximum. The operator must remember, however, that the full range of A.V.C. action cannot be obtained unless the R.F. GAIN control is fully advanced.

### 10.3 CW RECEPTION

**10.31** The initial adjustment of the RAS Equipment for CW reception is as described in Par. 10.21, except that the A.V.C. switch must be OFF. The C.W. OSC. control should be set at 9 on the scale.

**10.32** Although the settings of the R.F. GAIN and A.F. GAIN controls will depend to some extent upon operating conditions, it is recommended that the A.F. GAIN control be set at about 5 and the R.F. GAIN control advanced as may be required to provide a satisfactory audio signal. Advancing the R.F. GAIN control too much may cause I.F. or second detector overload. Such overload is indicated by a change in pitch of the CW beat note over the duration of a code character, or by excessive "thumping".

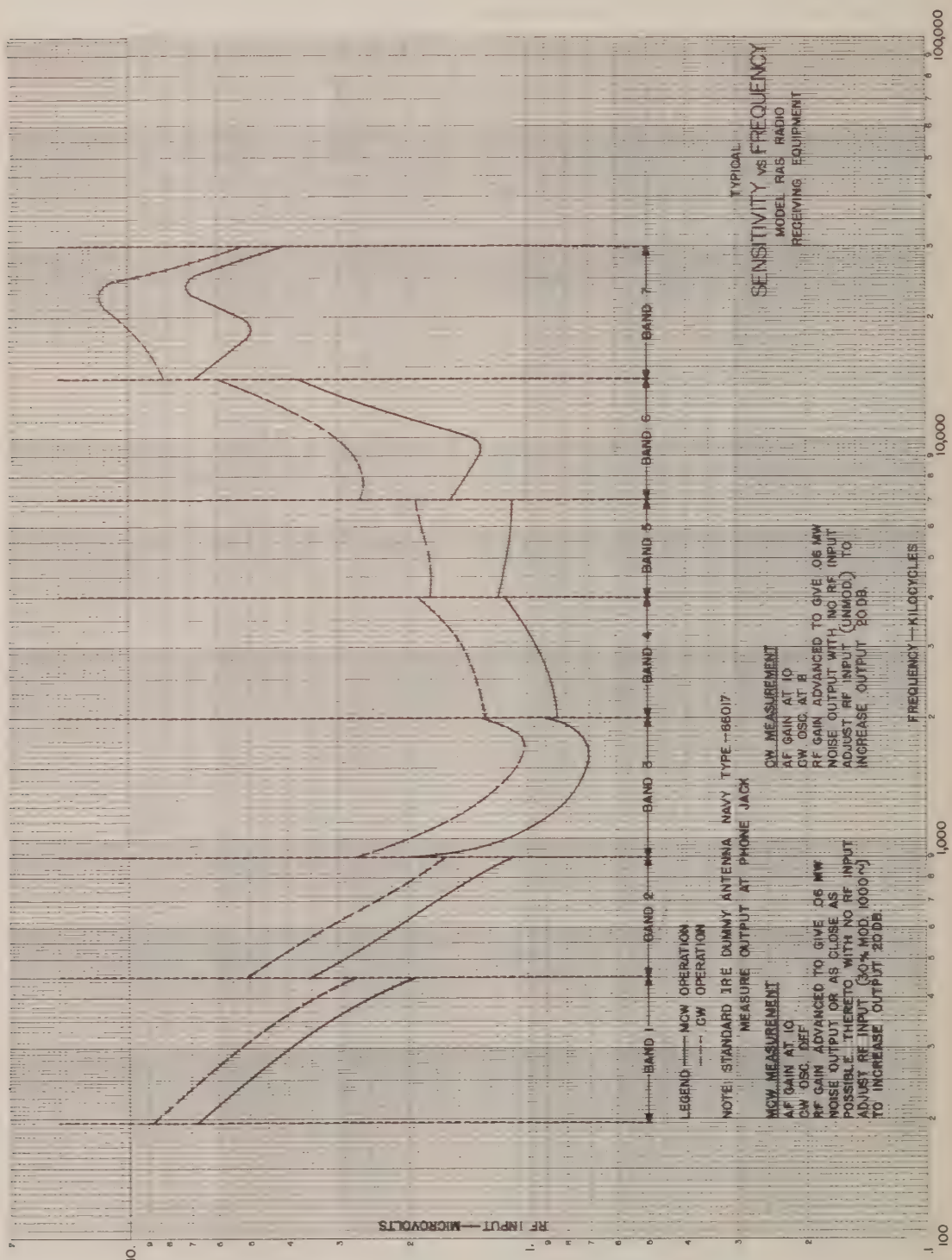
**10.33** The best setting of the C.W. OSC. control will also depend upon operating conditions. When the received signal is free from interference and is sufficiently strong to override static and circuit noise, it is recommended that the C.W. OSC. control be set at the position which tunes the C.W. oscillator to the intermediate frequency of the receiver. This setting will normally be between 8 and 10. As the control is turned counterclockwise, the C.W. oscillator is detuned from the intermediate frequency of the receiver. The operator can determine the extent of this deviation by listening to the characteristic pitch of background and circuit noises. When this pitch is 2000 or 3000 cycles, it will be found that the Receiver has definite "single signal" properties such that one side of the audio beat note of a received signal will be considerably louder than the other side. This characteristic is helpful in receiving weak signals through interference and utilizes the maximum available sensitivity and selectivity of the receiver.

**10.34** If the A.V.C. switch is turned ON, with the CW oscillator in operation, the Receiver will block and become extremely insensitive.

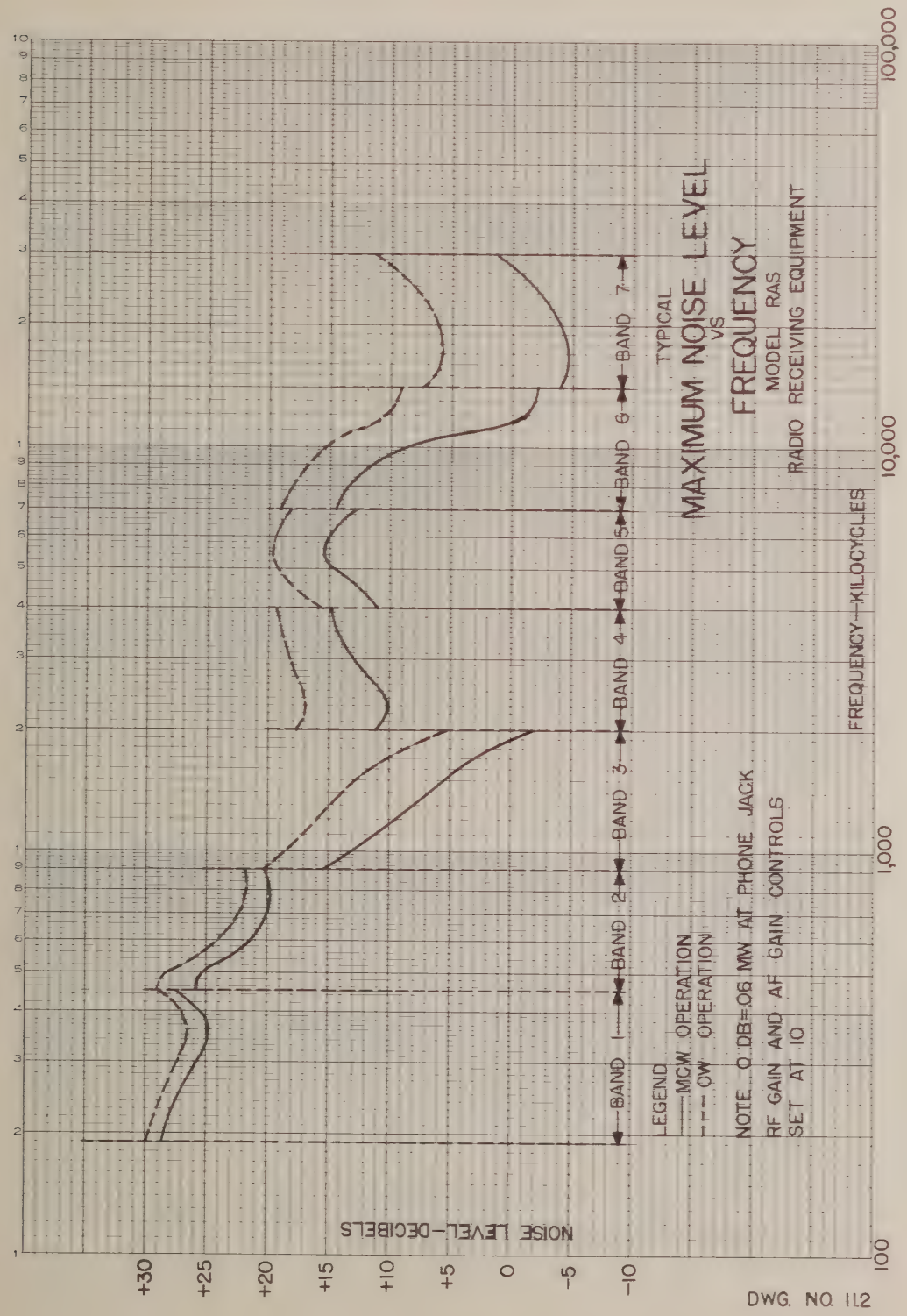
## 11. PERFORMANCE DATA

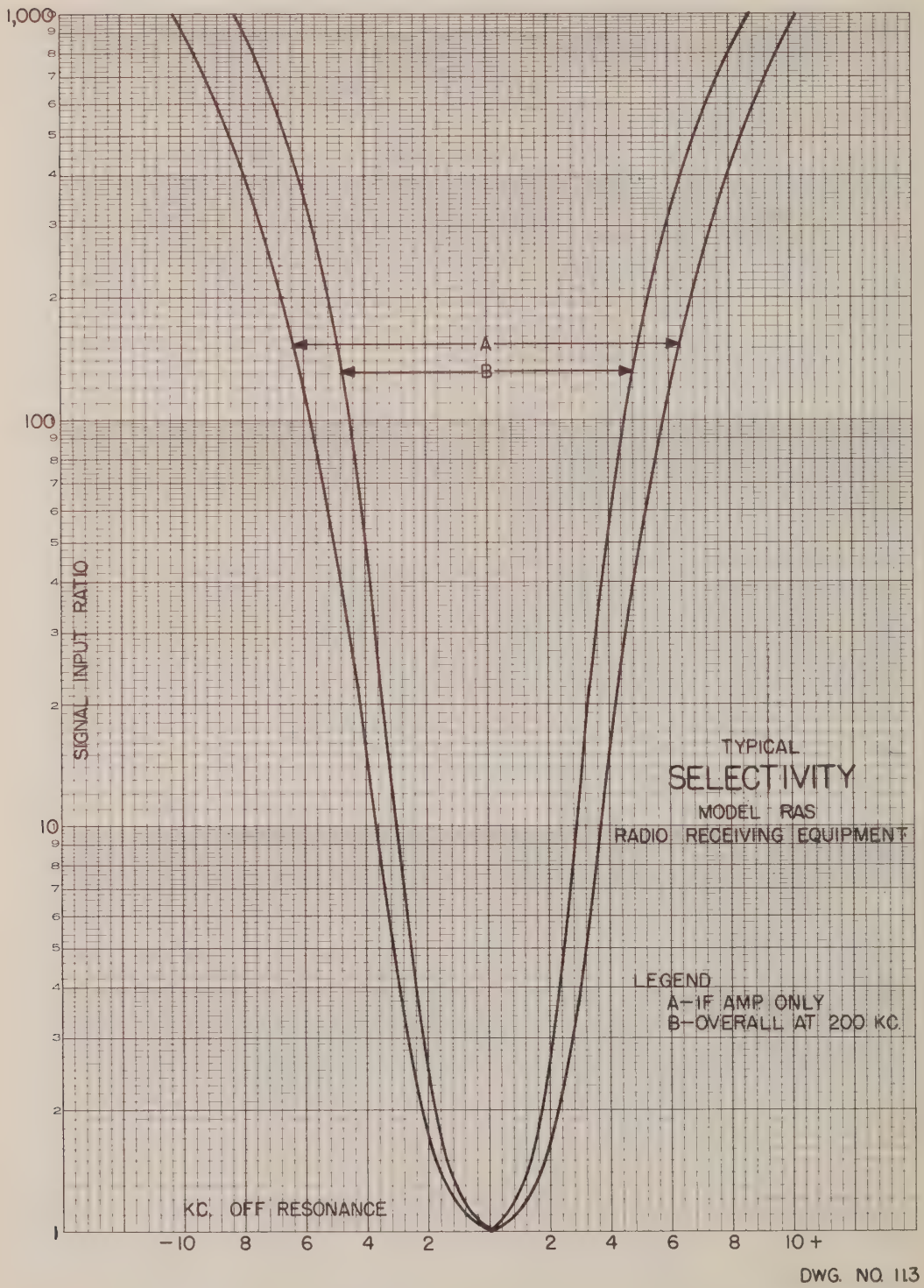
The SENSITIVITY vs. FREQUENCY curves of Dwg. No. 11.1 indicate the overall sensitivity of the Model RAS Radio Receiving Equipment. These curves, together with MAXIMUM NOISE LEVEL curves of Dwg. No. 11.2, provide data for definitely checking the Type CNA-46080 Radio Receiver to determine if repairs or realignment are necessary, since the majority of circuit element failures, or any misalignment, will reduce both sensitivity and maximum noise level of the Equipment. The data referred to above will, therefore, also serve to show the efficiency of repairs or realignment.

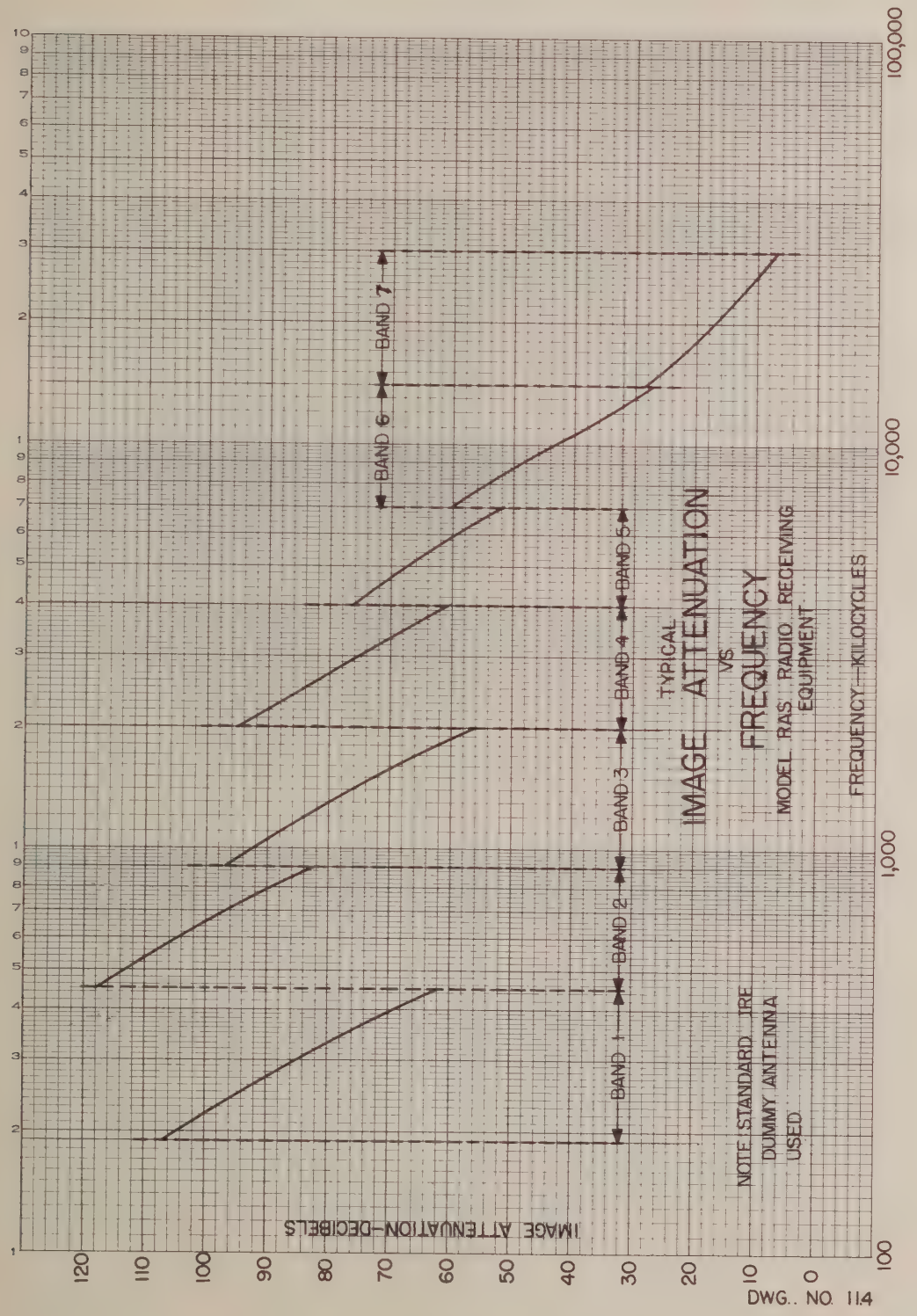
The SELECTIVITY, IMAGE ATTENUATION, FIDELITY and A.V.C. characteristics of Dwg. Nos. 11.3 to 11.6 inclusive are necessary where a particular performance check is desired, but are of secondary importance in most cases, since an Equipment having normal SENSITIVITY and MAXIMUM NOISE characteristics will, in all probability, be normal in all other respects.

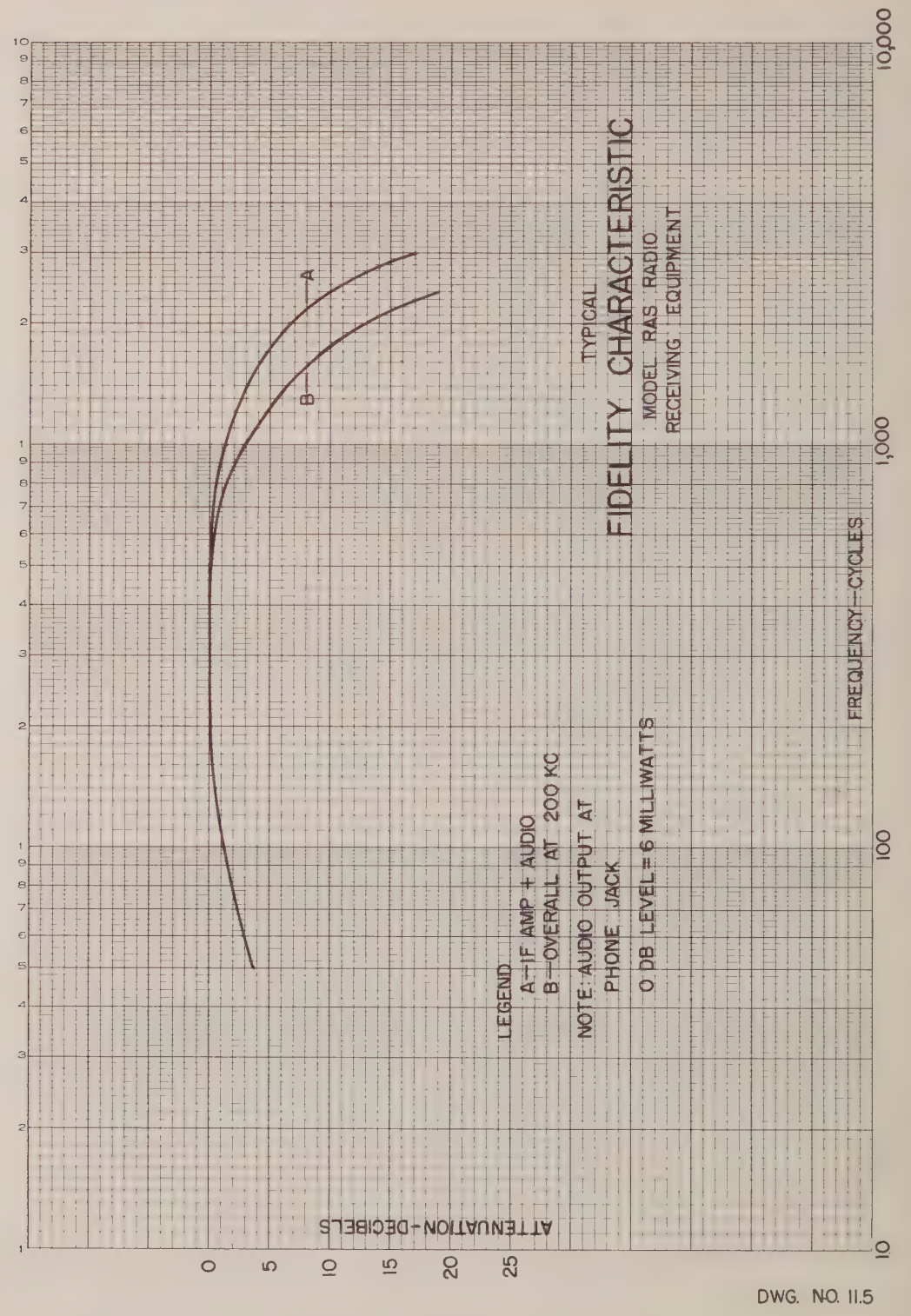

TYPICAL
SENSITIVITY VS FREQUENCY
MODEL RAS RADIO
RECEIVING EQUIPMENT
BAND 1
BAND 2
BAND 3
BAND 4
BAND 5
BAND 6
BAND 7
LEGEND —— MCW OPERATION
---- CW OPERATION
NOTE: STANDARD IRE DUMMY ANTENNA NAVY TYPE--86017
MEASURE OUTPUT AT PHONE JACK
MCW MEASUREMENT
AF GAIN AT 10
CW OSC. OFF
RF GAIN ADVANCED TO GIVE .06 MW
NOISE OUTPUT OR AS CLOSE AS
POSSIBLE THERETO WITH NO RF INPUT
ADJUST RF INPUT (30% MOD. 1000~)
TO INCREASE OUTPUT 20 DB.
CW MEASUREMENT
AF GAIN AT 10
CW OSC. AT B
RF GAIN ADVANCED TO GIVE .06 MW
NOISE OUTPUT WITH NO RF INPUT
ADJUST RF INPUT (UNMOD.) TO
INCREASE OUTPUT 20 DB.
RF INPUT — MICROVOLTS
FREQUENCY — KILOCYCLES
10.
1.
.1
100
1,000
10,000
100,000

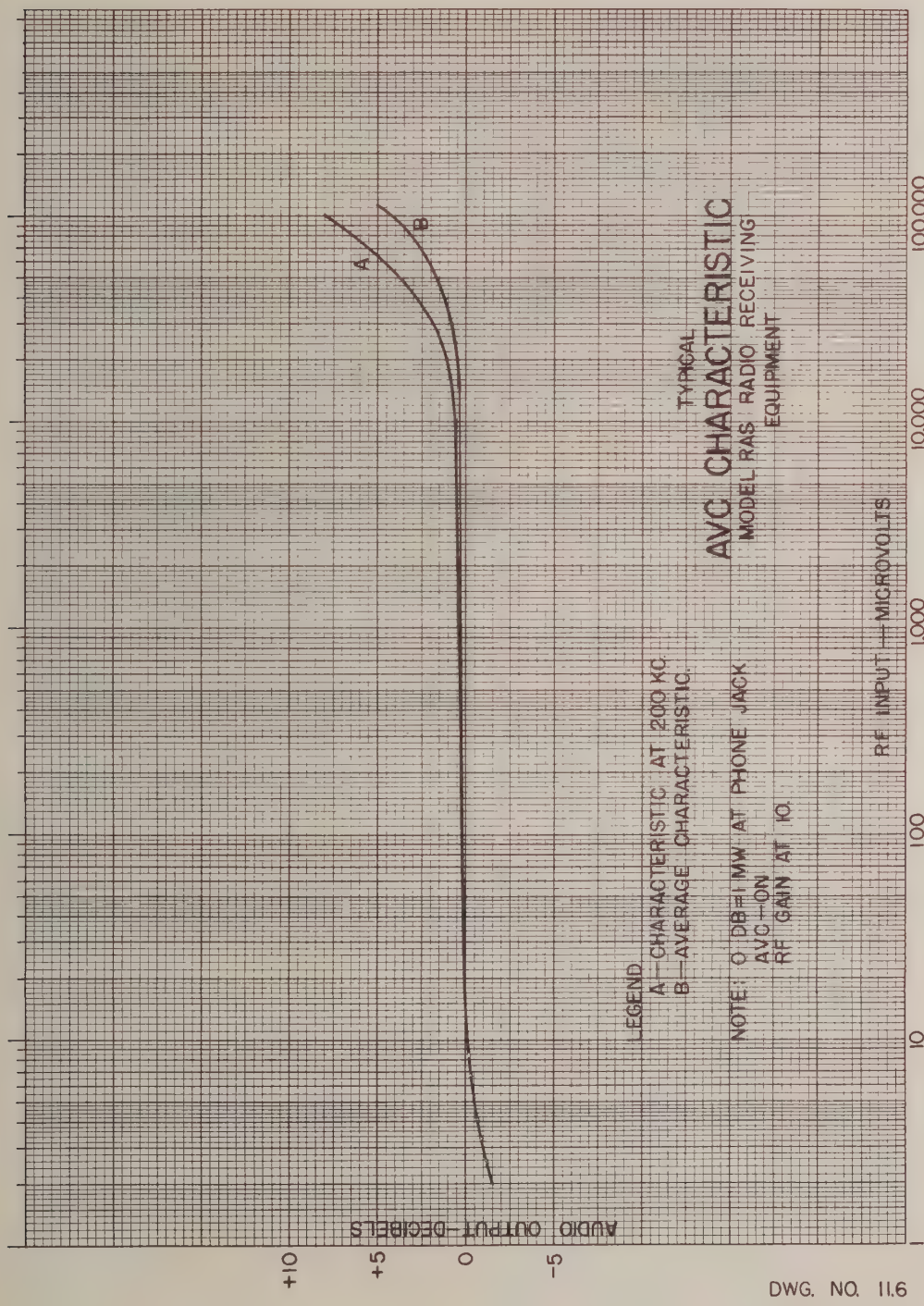
DWG. NO. 11.1

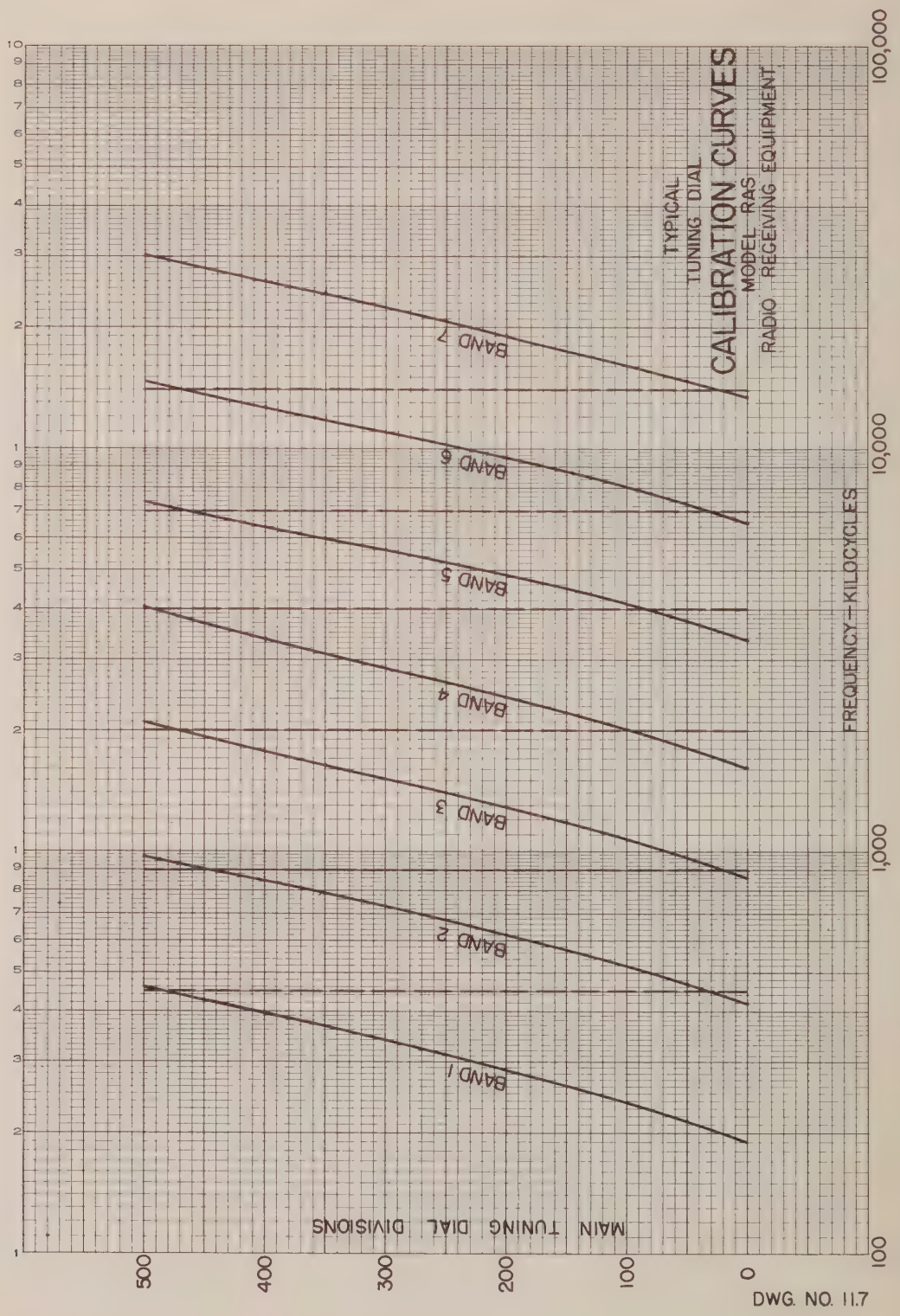

TYPICAL
MAXIMUM NOISE LEVEL
VS
FREQUENCY
MODEL RAS
RADIO RECEIVING EQUIPMENT
FREQUENCY—KILOCYCLES
100
1,000
10,000
100,000
NOISE LEVEL—DECIBELS
+30
+25
+20
+15
+10
+5
0
-5
-10
BAND 1
BAND 2
BAND 3
BAND 4
BAND 5
BAND 6
BAND 7
LEGEND
MCW OPERATION
CW OPERATION
NOTE .0 DB=.06 MW AT PHONE JACK
RF GAIN AND AF GAIN CONTROLS
SET AT 10
DWG. NO. 112


1,000
100
10
1
SIGNAL INPUT RATIO
A
B
TYPICAL
SELECTIVITY
MODEL RAS
RADIO RECEIVING EQUIPMENT
LEGEND
A—IF AMP ONLY
B—OVERALL AT 200 KC.
KC. OFF RESONANCE
−10 8 6 4 2 2 4 6 8 10+
DWG. NO. 113


TYPICAL
IMAGE ATTENUATION
VS
FREQUENCY
MODEL RAS RADIO RECEIVING EQUIPMENT
NOTE: STANDARD IRE DUMMY ANTENNA USED
BAND 1
BAND 2
BAND 3
BAND 4
BAND 5
BAND 6
BAND 7
IMAGE ATTENUATION—DECIBELS
FREQUENCY—KILOCYCLES
120
110
100
90
80
70
60
50
40
30
20
10
0
100
1,000
10,000
100,000
DWG.. NO. 114


TYPICAL
FIDELITY CHARACTERISTIC
MODEL RAS RADIO
RECEIVING EQUIPMENT
A
B
LEGEND
A—IF AMP + AUDIO
B—OVERALL AT 200 KC
NOTE: AUDIO OUTPUT AT
PHONE JACK
0 DB LEVEL = 6 MILLIWATTS
ATTENUATION-DECIBELS
0
5
10
15
20
25
FREQUENCY-CYCLES
10
100
1,000
10,000
DWG. NO. 11.5


AVC CHARACTERISTIC
TYPICAL
MODEL RAS RADIO RECEIVING EQUIPMENT
LEGEND
A—CHARACTERISTIC AT 200 KC.
B—AVERAGE CHARACTERISTIC.
NOTE: 0 DB=1 MW AT PHONE JACK
AVC—ON
RF GAIN AT 10.
RF INPUT—MICROVOLTS
1
10
100
1,000
10,000
100,000
AUDIO OUTPUT—DECIBELS
+10
+5
0
-5
A
B
DWG. NO. 11.6


CALIBRATION CURVES
MODEL RAS
RADIO RECEIVING EQUIPMENT
TYPICAL
TUNING DIAL
FREQUENCY—KILOCYCLES
100,000
10,000
1,000
100
BAND 7
BAND 6
BAND 5
BAND 4
BAND 3
BAND 2
BAND 1
MAIN TUNING DIAL DIVISIONS
500
400
300
200
100
0
DWG. NO. 11.7

## 12. MAINTENANCE — FAILURES AND REMEDIES

### 12.1 GENERAL

**12.11** Adequate test equipment for maintenance of the Model RAS Radio Receiving Equipment should include the following items:

(1) A Model LP Radio Frequency Standard Signal Generator Equipment, or equivalent.

(2) An audio output meter, General Radio Company Type 583A, or equivalent.

(3) A resistance bridge or ohmeter capable of measuring resistance from a fraction of an ohm to about 10 megohms.

(4) An analyzer of the type designed for testing vacuum tubes and measuring the D.C. potentials and currents in the circuits with which the tube under test is associated.

The performance and test data of Sections 11 and 13 were determined with equipment as listed above.

**12.12** In making any tests or adjustments, it is essential that the operator consider the influence that any one circuit element may have upon other associated circuits. The test data of Section 13 will be particularly helpful in determining the extent of such influence and the necessity for making further replacements after a fault in one particular circuit element has been located and repaired.

**12.13** Any repairs in the Model RAS Equipment which necessitate resoldering of joints should be made with care. The new joint should be such that the pieces to be soldered are firmly connected mechanically before solder is applied. After soldering, the joint should be covered with moisture resistant lacquer or varnish to conform with other soldered connections throughout the equipment.

### 12.2 TUBE REPLACEMENTS

**12.21** ALL TUBES SUPPLIED WITH THE EQUIPMENT OR AS SPARES ON THE EQUIPMENT CONTRACT SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

**12.22** All tubes in the Model RAS Equipment, except the type 6V6G° audio amplifier V-109, are standard in Naval service. Navy type designations are listed in Sections 3 and 7.

°6V6GT may be substituted.

**12.23** Failure of a vacuum tube in the Receiver may reduce the sensitivity of the equipment to radio signals, produce intermittent operation or cause the equipment to be completely inoperative. In such cases, all tubes should be checked either in an analyzer or similar tube testing equipment, or by replacement with tubes of proven quality. When any tube is tested, it should be tapped or jarred to make sure that it has no internal loose connection or intermittent short-circuit.

**12.24** When tube replacements become necessary, substitution of new tubes may alter the alignment of the R.F. or I.F. circuits inasmuch as the replacement tubes may not be identical with those originally employed. The necessity for realignment as well as alignment procedure is discussed in Section 14.

**12.25** A replacement high frequency oscillator tube V-104 should be checked in the Receiver as follows :apply a 25 to 30 megacycle unmodulated test signal of at least 10 microvolts at the antenna input terminals E-101. Tune in the signal with the receiver adjusted for MCW reception (see Par. 10.23), with the A.V.C. switch ON. Tap the replacement tube V-104 with a piece of insulating material or jar the receiver as a whole: this should not produce persistent microphonic noise in the loud speaker. Turn the A.V.C. switch OFF and turn the C.W. OSC. control to 9; retard the R.F. GAIN control as necessary to avoid overload and adjust the receiver to give an audible beat note. A poor replacement tube V-104 may cause "modulation hum" or 60 cycle modulation of the beat note. A good tube will not cause such modulation. The tube should be tapped to make sure that its characteristics will not change if the Receiver is subjected to vibration.

### 12.3 FAILURE OF THE RADIO RECEIVER

**12.31** In case of breakdown or failure of the Type CNA-46080 Radio Receiver, the fault must first be localized in one portion of the circuit. This can be accomplished by observation of some peculiar action of one of the controls or by checking the Receiver against the test data tabulated in Section 13. Reference to Dwg. No. 16.10 and Dwgs. 16.13 to 16.19 inclusive, and Photos Nos. 17.01, 17.02 and 17.09 to 17.18 inclusive will show the location of any component part of the receiver. Functions and ratings of component parts are given in the Parts Lists, Section 15.

**12.32** It must be remembered that the test data of Section 13 will not positively

locate certain faults. For instance, an open-circuited by-pass capacitor will not appear in point to point resistance tests and may introduce regeneration or oscillation in certain circuits which affect the stage gain of other circuits. Similarly, a short-circuit occurring in a low resistance inductor will not appear in point to point resistance tests and if the short appears in an R.F. coil, a false indication of the necessity for realignment may result.

**12.33** By-pass or filter capacitors which develop poor connections internally or which become open-circuited will cause decreased sensitivity and or poor stability. The defective unit can be located by temporarily connecting a good capacitor in parallel with each capacitor that is under suspicion.

**12.34** Failure of any by-pass or filter capacitor may seriously overload resistors of the associated circuits. Overloads of sufficient magnitude to permanently damage a resistor will cause the painted surface of the resistor to be scorched, making the defective unit easy to locate by visual inspection.

**12.35** Open- or short-circuited resistors can be definitely located by testing the resistance of each individual resistor. The wiring diagram, Dwg. No. 16.10, should be consulted to make sure that any particular resistor under test is not connected in parallel with some other circuit element which might produce false measurement.

**12.36** Loose connections which cause intermittent or noisy operation which cannot be found by point to point resistance tests, or by other test data of Section 13, can be located by individually testing each circuit element or by tapping or shaking any component under suspicion, with the Receiver adjusted for normal operation.

### 12.4 FAILURE OF THE POWER UNIT

**12.41** In case of failure of the Type CNA-20089 or CNA-20090 Power Unit, the voltage chart of Section 13 will provide the best means for locating the fault. Individual components should be checked to make sure that they have the characteristics listed under "Description" of Section 15, Table 1, Section 2.

**12.42** One or both primary fuses F-201, F-202, will blow out, opening the primary circuit of transformer T-201, when a failure occurs in the power transformer or rectifier circuit which produces a sustained primary current in excess of approximately 1.5 amperes. Failure of one or both filter capacitors C-203 and C-204 will blow out one or both fuses. Failure of capacitor C-205 or capacitor C-206 or a failure in the B supply circuits of the Type CNA-46080 Radio Receiver will not produce sufficient overload to harm any component of the Power Unit and the fuses will not blow out when such failures occur.

**12.43** The rectifier tube V-201 and the fuses F-201, F-202 are made accessible by removing the metal grille which is attached to the Power Unit panel by four knurled thumb screws.

### 12.5 FAILURE OF LOUD SPEAKER

**12.51** In case of failure of the Type CNA-49105 or CNA-49106 Loud Speaker, the primary and secondary of transformer T-301 and the voice coil of loud speaker LS-301 should be checked for open- or short-circuits. Transformer T-301 may also be checked by disconnecting the voice coil and connecting secondary terminals 3 and 4 directly to an output meter, the impedance of which must, in this case, be approximately 2.8 ohms. A normal transformer T-301 will show a power loss of 1 db. at 400 cycles.

**12.52** Rattles or scratching noises which may accompany a signal can be caused by improper centering of the voice coil of Loud Speaker LS-301 or by small particles of foreign matter in the air gap between the voice coil and permanent magnet field. The air gap may be cleaned by removing Loud Speaker LS-301 from its cabinet and brushing or wiping the inside of the annular gap with a narrow strip of paper. In reassembling the Loud Speaker, care must be taken to avoid distorting the cone mounting frame when the speaker mounting nuts are tightened.

**12.53** In some installations where the equipment is subjected to considerable vibration, or where vacuum tubes show microphonic tendencies, it is often possible to eliminate sustained microphonic audio oscillation by reversing the loud speaker leads. Such procedure is not ordinarily required and is recommended only in cases of emergency where replacement tubes free from microphonism, are not available.

## 13. TEST DATA

The TUBE SOCKET VOLTAGES AND CATHODE CURRENTS Table 13.1 must not be considered as a list of the actual op-circuits of the Type CNA-46080 Radio Receiver. The resistance of the measuring instruments, together with capacitive and

resistive loading effects, will disturb many of the circuits to such an extent that they become inoperative, thus altering normal voltage and current distribution.

The only currents listed in Table 13.1 are those in the various cathode circuits. This listing is a desirable simplification, inasmuch as measurement of cathode current constitutes a definite check on all circuits directly associated with the vacuum tube in question.

The POINT TO POINT RESISTANCE Table 13.2 shows average resistance values in the Type CNA-46080 Radio Receiver with the Type CNA-49105 or CNA-49106 Loud Speaker disconnected from terminals E-107, and cable plug P-101 disconnected from the Power Unit socket J-202. The vacuum tubes need not be removed from their sockets. In using Table 13.2, the statements of Par. 12.32 must be given careful consideration.

**13.1 TUBE SOCKET VOLTAGES AND CATHODE CURRENTS**

| *Terminal* | *Variable* | | *Voltage D.C. Volts* | | *Current D.C. MA.* | |
|---|---|---|---|---|---|---|
| | *Symbol* | *Setting* | *R-115 At 0* | *R-115 At 10* | *R-115 At 0* | *R-115 At 10* |
| V-101 Grid | None | | 0 | 0 | | |
| V-101 Cathode | None | | A 3 | A 2 | 8. | 6. |
| V-101 Screen | None | | B 100 | B 56 | | |
| V-101 Plate | None | | B 190 | B 170 | | |
| V-102 Grid | None | | 0 | 0 | | |
| V-102 Cathode | None | | A 28 | A 2 | .4 | 6. |
| V-102 Screen | None | | B 100 | B 56 | | |
| V-102 Plate | None | | B 190 | B 170 | | |
| V-103 Grid | None | | 0 | 0 | | |
| V-103 Cathode | See # | | A 4 | A 3.5 | .8 | .7 |
| V-103 Screen | See # | | B 70 | B 64 | | |
| V-103 Plate | None | | B 190 | B 170 | | |
| V-104 Grid | See # | | —* | —* | | |
| V-104 Cathode | See # | | 0 | 0 | —* | —* |
| V-104 Screen | See # | | B 110* | B 100* | | |
| V-104 Plate | See # | | B 190* | B 170* | | |
| V-105 Grid | None | | 0 | 0 | | |
| V-105 Cathode | None | | A 29 | A 2 | .4 | 6. |
| V-105 Screen | None | | B 112 | B 68 | | |
| V-105 Plate | None | | B 182 | B 150 | | |
| V-106 Grid | None | | 0 | 0 | | |
| V-106 Cathode | None | | A 32 | A 5.5 | .4 | 1.5 |
| V-106 Screen | None | | B 110 | B 68 | | |
| V-106 Plate | None | | B 180 | B 150 | | |
| V-107A Grid | None | | 0 | 0 | | |
| V-107A Cathode | S-101 | OFF | A 7.5 | A 7.5 | .4 | .4 |
| V-107A Cathode | S-101 | ON | A 12.5 | A 12. | .6 | .6 |
| V-107A Plate | S-101 | OFF | B 125 | B 110 | | |
| V-107A Plate | S-101 | ON | B 105 | B 93 | | |
| V-107B Grid | See ° | | 0 | 0 | | |
| V-107B Cathode | See ° | | A 6 | A 7.5 | 0 | 0 |
| V-107B Plate | None | | 0 | 0 | | |
| V-108 Grid | S-101 | | See * | See * | | |
| V-108 Cathode | S-101 | OFF | 0 | 0 | 0 | 0 |
| V-108 Cathode | S-101 | ON | 0 | 0 | See * | See * |
| V-108 Screen | S-101 | OFF | 0 | 0 | | |
| V-108 Screen | S-101 | ON | B 14 * | B 12 * | | |
| V-108 Plate | S-101 | OFF | 0 | 0 | | |
| V-108 Plate | S-101 | ON | B 33 * | B 30 * | | |
| V-109 Grid | See ° | | 0 | 0 | | |
| V-109 Cathode | See ° | | A 11.5 | A 11. | 46. | 44. |
| V-109 Screen | See ° | | B 250 | B 245 | | |

*(Continued on next page)*

**13.1 TUBE SOCKET VOLTAGES AND CATHODE CURRENTS (*Continued*)**

| *Terminal* | *Variable* | | *Voltage D.C. Volts* | | *Current D.A. MA.* | |
|---|---|---|---|---|---|---|
| | *Symbol* | *Setting* | *R*-115 *At* 0 | *R*-115 *At* 0 | *R*-115 *At* 10 | *R*-115 *At* 10 |
| V-109 Plate | See ° | | B 240 | B 230 | | |
| Chassis | See ° | | B 58 | B 70 | | |

All measurements made with equipment connected for normal operation. Power input 115 volts, 25 or 60 cycles. A.V.C. switch S-102 turned OFF and C.W. OSC. control turned OFF unless otherwise specified.

Voltage measurements made with a D.C. voltmeter, 1000 ohms per volt. "A" readings taken on 0-50 volt scale, *i.e.*, meter resistance is 50,000 ohms. "B" readings taken on 0-250 volt scale, *i.e.*, meter resistance is 250,000 ohms. Unless otherwise specified, voltage is measured between terminal and receiver chassis.

All readings will depend (in varying degree) upon the resistance of the meter. Readings not marked with an asterisk are subject to a variation of plus or minus 15%.

# Voltages and currents in this circuit are influenced by the setting of the tuning capacitor C-101, and by the radio frequency band in use. Measurement (if any) taken at 2000 kilocycles using Type CNA-47159 Coil Set (No. 4).

* Accurate measurement of voltage and/or current in this circuit cannot be made with an "analyzer" due to loading effects.

° This voltage measurement is made between terminal and B minus. Negative terminal of voltmeter to B minus.

**13.2 POINT TO POINT RESISTANCES**
**(*Terminal to Chassis*)**

| *Terminal* | *Variable* | | *Resistance (Ohms) Plus or Minus 15%* |
|---|---|---|---|
| | *Symbol* | *Setting* | |
| V-101 Grid | S-102 | ON | 1,100,000 |
| V-101 Grid | S-102 | OFF | 500,000 |
| V-101 Cathode | None | | 300 |
| V-101 Screen | R-115 | 0 | 37,000 |
| V-101 Screen | R-115 | 10 | 32,000 |
| V-101 Plate | R-115 | 0 | 39,000 |
| V-101 Plate | R-115 | 10 | 34,000 |
| V-102 Grid | S-102 | ON | 1,100,000 |
| V-102 Grid | S-102 | OFF | 500,000 |
| V-102 Cathode | R-115 | 0 | 9,800 |
| V-102 Cathode | R-115 | 10 | 300 |
| V-102 Screen | R-115 | 0 | 37,000 |
| V-102 Screen | R-115 | 10 | 32,000 |
| V-102 Plate | R-115 | 0 | 39,000 |
| V-102 Plate | R-115 | 10 | 34,000 |
| V-103 Grid | None | | See # |
| V-103 Cathode | None | | 5,000 |
| V-103 Screen | R-115 | 0 | 145,000 |
| V-103 Screen | R-115 | 10 | 142,000 |
| V-103 Plate | R-115 | 0 | 41,000 |
| V-103 Plate | R-115 | 10 | 36,000 |
| V-104 Grid | None | | 20,000 |

**13.2 POINT TO POINT RESISTANCES (*Continued*)**
**(*Terminal to Chassis*)**

| *Terminal* | *Variable* | | *Resistance (Ohms) Plus or Minus 15%* |
|---|---|---|---|
| | *Symbol* | *Setting* | |
| V-104 Cathode | None | | See # |
| V-104 Screen | R-115 | 0 | 45,000 |
| V-104 Screen | R-115 | 10 | 42,000 |
| V-104 Plate | R-115 | 0 | 41,000 |
| V-104 Plate | R-115 | 10 | 36,000 |
| V-105 Grid | S-102 | ON | 1,100,000 |
| V-105 Grid | S-102 | OFF | 500,000 |
| V-105 Cathode | R-115 | 0 | 9,800 |
| V-105 Cathode | R-115 | 10 | 300 |
| V-105 Screen | R-115 | 0 | 32,000 |
| V-105 Screen | R-115 | 10 | 27,000 |
| V-105 Plate | R-115 | 0 | 41,000 |
| V-105 Plate | R-115 | 10 | 36,000 |
| V-106 Grid | S-102 | ON | 1,100,000 |
| V-106 Grid | S-102 | OFF | 500,000 |
| V-106 Cathode | R-115 | 0 | 10,800 |
| V-106 Cathode | R-115 | 10 | 1,500 |
| V-106 Screen | R-115 | 0 | 32,000 |
| V-106 Screen | R-115 | 10 | 27,000 |
| V-106 Plate | R-115 | 0 | 41,000 |
| V-106 Plate | R-115 | 10 | 36,000 |
| V-107A Grid | None | | 47.5 |
| V-107A Cathode | None | | 20,000 |
| V-107A Plate | R-115 | 0 | 120,000 |
| V-107A Plate | R-115 | 10 | 115,000 |
| V-107B Grid | None | | 500,000 |
| V-107B Cathode | None | | 2,000 |
| V-107B Plate | S-102 | ON | 100,000 |
| V-107B Plate | S-102 | OFF | 83,000 |
| V-108 Grid | None | | 50,000 |
| V-108 Cathode | None | | 6. |
| V-108 Screen | S-101 | ON | 80,000 |
| V-108 Screen | S-101 | OFF | 100,000 |
| V-108 Plate | S-101 | ON | 120,000 |
| V-108 Plate | S-101 | OFF | 200,000 |
| V-109 Grid | R-136 | 0 | 2,250 |
| V-109 Grid | R-136 | 10 | 500,000 |
| V-109 Cathode | None | | 2,500 |
| V-109 Screen | R-115 | 0 | 39,000 |
| V-109 Screen | R-115 | 10 | 34,000 |
| V-109 Plate | None | | Inf. |
| B Minus | None | | 2,250 |

# Refer to "Parts List by Symbol Designations"
Sub-sections 4 to 10 inclusive.

### 13.3 STAGE GAIN MEASUREMENTS

The sensitivity measurements listed below are made under the following conditions. The Model RAS Equipment is set up in accordance with Par. 14.14 with Coil Set No. 4 in operation. The Standard Signal Generator is connected in accordance with Par. 14.23 except that the high output lead is connected to the grid of the tube specified in the list below, and the test signal is 175 ± .5 Kc. modulated 30% 400 cycles. Both R.F. GAIN and A.F. GAIN controls of the receiver must be fully advanced, the A.V.C. switch must be OFF, and the C.W. OSC. control must be OFF.

With 6 milliwatt output at the phone jack, the test signal should be within the limits specified below. The same data will apply with 500 milliwatt output at the speaker terminals E-107, the output meter being connected in place of the Loud Speaker.

| *Terminal* | *Test Signal* |
|---|---|
| V-103 Grid | 34 ± 10 Microvolts |
| V-105 Grid | 1000 ± 200 Microvolts |
| V-106 Grid | 40000 ± 8000 Microvolts |
| V-107A Grid | Over 1. Volt |

## 14. ALIGNMENT DATA

### 14.1 GENERAL

**14.11** Should realignment of the Type CNA-46080 Radio Receiver become necessary, the following alignment data should be carefully studied before making any circuit adjustments. It is important that the operator understand the function of each circuit element so that correct alignment may be obtained quickly and accurately. The alignment data of this section is, therefore, supplemented by Section 8, Construction, and Section 9, Circuit Description.

**14.12** Performance data and test data presented in Sections 11 and 13 will be particularly helpful in determining the necessity for making any specific adjustment. The operator is cautioned against making any adjustments indiscriminately and he should not realign any circuit unless tests definitely indicate that realignment is necessary.

**14.13** All alignment and calibration tests, measurements, etc., may be made with the Model LP Standard Signal Generator, or similar equipment, and an output meter, General Radio Type 583A, or equivalent. In checking possible calibration errors, it should be remembered that the calibration accuracy of the Type CNA-46080 Radio Receiver is of the same order as that of the Model LP Standard Signal Generator. All tests are made with the Signal Generator adjusted to provide a test signal having 1000 cycle 30% modulation, unless otherwise specified.

**14.14** Before proceeding with the alignment of any circuit of the Type CNA-46080 Radio Receiver, the Receiver must be taken out of the Mounting Rack and the dust cover removed. The power supply cable plug P-101 must be inserted in socket E-201 of the Type CNA-20089 or CNA-20090 Power Unit and the shield of cable W-101 grounded to the power unit chassis, as explained under Par. 6.4. An output meter having a 600 ohm resistive load should be connected to the phone output jack J-101. In this case, the speaker remains connected to terminals E-107. The R.F. GAIN control should be fully advanced, C.W. OSC. control turned OFF and the A.V.C. switch turned OFF. The B+ switch should be turned ON. One of the Coil Sets should be plugged into the Receiver, even though the operator plans to align and check only the I.F. or audio circuits. The frequency range of the coil set is in such cases specified in the data of Sections 11 and 13.

**14.15** The complete alignment of the Radio Receiver may be divided into four steps:

(1) Intermediate frequency amplifier alignment.
(2) High frequency oscillator alignment.
(3) Radio frequency amplifier alignment.
(4) Tracking of H.F. oscillator and R.F. amplifier circuits.

The circuits *must* be checked in the above order when complete alignment is necessary.

### 14.2 I.F. AMPLIFIER ALIGNMENT

**14.21** The intermediate frequency of the Type CNA-46080 Radio Receiver is 175 kilocycles, plus or minus 1 kilocycle.

**14.22** Tuning adjustments are provided on each I.F. transformer. These adjustments are designated by symbol numbers C-115, C-116, C-121, C-122, C-131 and C-132, as indicated on Photo No. 17.18.

**14.23** The high output lead of the Model LP Standard Signal Generator should be connected to the grid terminal of the first detector tube V-103 and the ground lead to any metal part making direct connection to the chassis. The flexible grid lead must be disconnected from tube V-103. Connection should be made directly from the output jack of the Standard Signal Generator, the dummy antenna being omitted. Certain types of Signal Generators other than the Model LP may not have a complete D.C. path between the two output leads; in such cases, a resistor having a value between 5,000 and 50,000 ohms should be connected between the grid of the tube V-103 and chassis, to provide a grid return path.

**14.24** The frequency of the Signal Generator should be carefully adjusted to 175 kilocycles and the signal input to tube V-103 adjusted to provide a reading on the output meter, with the A.F. GAIN control of the receiver fully advanced. The I.F. tuning adjustments listed in Par. 14.22 should each be carefully adjusted to give a maximum reading on the output meter. The order in which the adjustments are made is unimportant. While making these adjustments, it may be necessary to reduce the signal input to the receiver in order to avoid overload in the second detector or audio circuits. Such overload will make the various I.F. trimmer adjustments appear to be considerably less critical than they actually are and may, in extreme cases, indicate incorrect peak adjustments. To be safe, audio output should not exceed 50% of the values specified in Par. 2.12.

**14.25** The performance of the I.F. amplifier and audio circuits can be checked against the stage gain data in Section 13, Par. 13.3, after alignment has been completed. Similarly, the selectivity may be checked against the data in Section 11, Dwg. No. 11.3.

**14.26** After alignment of the I.F. amplifier has been checked and found to be correct, the CW oscillator should be turned on, the C.W. OSC. control knob being set at 9. Either of capacitors C-144 or C-145, as shown in Photo No. 17.18, should be adjusted so that the frequency of the CW oscillator zero beats with the 175 kilocycle test signal of the Standard Signal Generator. A modulated test signal is not necessary when making this adjustment.

### 14.3 HIGH FREQUENCY OSCILLATOR ALIGNMENT

**14.31** The need for realignment of the high frequency oscillator section of any of the coil sets is indicated if the frequency calibration of the coil set is found to be in error by more than five divisions (plus or minus) at dial settings between 480 and 490. See Par. 14.13. If there is doubt concerning the necessity for high frequency oscillator realignment, this portion of the circuit should not be adjusted as any misalignment can be corrected by R.F. amplifier trimmer adjustments. See Sub-Section 14.4.

**14.32** To check the operation of the R.F. amplifier and high frequency oscillator circuits, the Receiver is set up as described under Par. 14.14, except that the Coil Set under test must be plugged into the Receiver. The Model LP Standard Signal Generator or equivalent should be connected to the antenna input terminals through a standard dummy antenna, such as the Type CAG-66017, or as specified in the data of Sections 11 and 13. The R.F. GAIN control may be retarded somewhat if desired, as background noise may be excessive when the control is fully advanced.

**14.33** Error in frequency calibration is corrected by adjustment of the high frequency oscillator trimmer capacitor indicated as Number 5 in Photo No. 17.18. A screwdriver having a metal shaft may be used but the shaft should not touch any part of the receiver chassis while making the adjustment. If the Receiver tunes to a certain frequency (near the high frequency end of the coil set range) with a numerical dial reading lower than that indicated by the calibration chart, correction is made by turning trimmer Number 5 in a clockwise direction to increase its capacity; conversely, high dial readings are corrected by turning trimmer Number 5 counterclockwise.

**14.34** When aligning certain of the Coil sets, notably, Types CNA-47161 and CNA-47162, at 14.4 and 30.0 megacycles respectively, it will be found that adjustment of the first detector trimmer Number 3, as shown in Photo No. 17.18, will change the calibration of the high frequency oscillator circuit. See Par. 14.42.

**14.35** It is particularly important that the high frequency oscillator circuits operate at a higher frequency than that of the R.F. amplifier circuits. This can be checked by tuning in the image of the test signal, which is normally 350 kilocycles lower on the dial. When checking the Type CNA-47162 Coil Set near the high frequency limit of its range, the image should appear at a dial reading approximately twelve divisions lower than that of the real signal. When checking the Type CNA-47161 Coil Set, the image will appear approximately twenty-five divisions lower. The image signal should be considerably weaker (see Dwg. No. 11.4) if the R.F. amplifier is correctly aligned and a stronger test signal may be required before the image can be found. If the image signal appears at a higher dial setting rather than a lower setting, as described above, the H.F. oscillator circuit is incorrectly adjusted and the capacity of trimmer Number 5 must be decreased until the real signal and image signal appear at the proper points on the dial.

### 14.4 R.F. AMPLIFIER ALIGNMENT

**14.41** The term "R.F. amplifier alignment", used in this Section, includes the alignment of both R.F. amplifier and first detector circuits. The set-up for checking or aligning the R.F. amplifier of the Type CNA-46080 Radio Receiver is the same as that described under Par. 14.32.

**14.42** With the test signal from the Standard Signal Generator adjusted to provide a modulated signal near the high frequency limit of the coil set tuning range, tune the Receiver to give maximum output, as indicated by the output meter. R.F. trimmers Numbers 3, 2 and 1, as shown on Photo No. 17.18, may now be adjusted to give maximum output meter reading. On certain of the Coil Sets, notably, Types CNA-47161 and CNA-47162, interaction between the R.F. trimmers and the high frequency oscillator circuit will necessitate retuning the Receiver to the test signal or "rocking" the tuning dial back and forth across the test signal. If the R.F. trimmers should require considerable realignment, it may be necessary to readjust high frequency oscillator trimmer Number 5 as described in Par. 14.33 in order to maintain correct calibration. Should such readjustment of trimmer Number 5 be required, the setting of trimmers Numbers 3, 2 and 1 should be re-checked.

**14.43** A very simple and quick method of R.F. trimmer alignment may be used if a Standard Signal Generator is not available. This method consists of setting trimmers Numbers 3, 2 and 1 at the adjustment which produces maximum circuit or background noise. It will be found that trimmer settings obtained by using this method are sufficiently accurate to provide good alignment, although the adjustment must be made with care, particularly in the case of the Number 1 trimmer. The operator must also be careful to avoid alignment to the image frequency.

### 14.5 TRACKING OF H.F. OSCILLATOR AND R.F. AMPLIFIER CIRCUITS

**14.51** After the H.F. oscillator and R.F. amplifier trimmers have been checked in accordance with Sub-Sections 14.3 and 14.4, near the high frequency limit of the coil set under test, the Receiver should be tuned near the low frequency limit of the coil set tuning range; the dial setting may be between 0 and 10. Tracking at this point may be checked by adjusting the Standard Signal Generator to the proper frequency and testing the setting of trimmers Numbers 3, 2 and 1 for maximum response. After such a test, trimmers Numbers 3, 2 and 1 should be realigned in accordance with Par. 14.42, since their settings are most critical at the high frequency end of the coil set tuning range. A simpler and quicker tracking check may be made by bending the outside rotor plates of each section of the main tuning capacitor C-101 in turn so that the maximum capacity of each circuit may be increased or decreased by a small amount. The rotor plates should not be bent so much that they will not return to their original positions when pressure is removed. Any change in capacity in any section of the main tuning capacitor should decrease the sensitivity of the receiver.

**14.52** Errors in tracking near the low frequency limit of the coil set tuning range can be caused by defects in any of three circuit elements.

(1) The tuning capacitor section.
(2) The circuit inductance.
(3) The oscillator series padding capacitor.

**14.521** In order to determine if one or more sections of the main tuning capacitor C-101 are the cause of mis-tracking, it is necessary to make the check described under Par. 14.51 with two or more different plug-in Coil Sets. If the same tracking error appears regardless of the Coil Set in use, the main tuning capacitor is definitely at fault. The error may be corrected by

permanently bending the rotor or stator plates to provide the proper capacity.

**14.522** If the tracking error appears only in the first R.F., second R.F. or first detector stage of one coil set, the inductance of the circuit in question is incorrect. All R.F. transformers which may require re-adjustment of inductance are fitted with inductive trimmers in the form of a wire loop or adjustable turn at the high potential end of the tuned secondary winding. Inductance is increased by moving the turn or loop to provide a more complete and compact solenoid. Inductive trimmers are indicated in Dwg. Nos. 16.13 to 16.19, inclusive, by arrows drawn through the upper end of the tuned secondary winding. If the tracking check of Par. 14.51 shows that more capacity is needed for correct alignment,the inductance of the tuned secondary in question is too low and must be increased by means of the inductive trimmer. Conversely, if the tracking check indicates the need of lower capacity, circuit inductance is too high and must be decreased. After any adjustment of inductance, the associated trimmer capacitor must be re-adjusted at the high frequency end of the coil range, as explained under Par. 14.42. Tracking should then be checked again at the low frequency end of the coil range, as explained under Par. 14.51.

**14.523** Should the tracking checks of Par. 14.51 and Par. 14.521 indicate that the high frequency oscillator circuit of a particular coil set is at fault, either the inductance of the high frequency oscillator circuit or the series padding capacitor may be responsible. Incorrect inductance in the high frequency oscillator circuit will cause a uniformly increasing error in tracking as the Receiver is tuned from the high frequency end of the coil set tuning range to the mid-point of the tuning range. Incorrect series padding capacity (with correct inductance) will produce a tracking error which increases rapidly as the low frequency limit of the coil set tuning range is approached. It must be remembered, however, that both the circuit inductance and series padding capacity have a very definite effect upon tracking over the entire frequency range of the coil set and, in consequence, it may be difficult to determine which circuit element is at fault.

The Types CNA-47156, -47157 and -47158 Coil Sets are fitted with variable series padding capacitors, the adjustment being indicated as trimmer Number 4 in Photo No. 17.18. Capacity increases with clockwise rotation of trimmer Number 4. If any of the series padding capacitors in the Types CNA-47159 to -47162 Coil Sets are inaccurate, the capacitor in question must be replaced, since no means of adjustment are provided.

Three types of inductive trimmers are employed in the high frequency oscillator circuits. The Types CNA-47156, -47157 and -47158 Coil Sets are each fitted with a copper ring. The position of this ring can be changed to vary its coupling with the tuned circuit inductor. Increased coupling (closer spacing) decreases the circuit inductance and vice versa. The Types CNA-47159 and CNA-47160 are each fitted with brass discs mounted inside the high frequency oscillator (solenoid) inductor. The position of the brass disc can be changed by turning a check-nut which is accessible through an opening in the rear of the high frequency oscillator transformer shield. Turning the check-nut in a clockwise direction decreases circuit inductance and vice versa. The Types CNA-47161 and CNA-47162 Coil Sets are each fitted with adjustable turns or loops which are part of the inductor winding. Inductance is increased by moving the turn or loop to provide a more complete solenoid.

If a tracking check made in accordance with Par. 14.51 shows mis-tracking at the low frequency end of the tuning range, while a similar check at the middle of the tuning range shows the tracking error to be negligible, the series padding capacitor should be re-adjusted. A tracking check indicating the need for more capacity at the low frequency end of the range shows the series padding capacitor to be too small and vice versa. If tests show tracking to be correct at the low frequency end of the tuning range but indicate that more circuit capacity is needed in the middle of the tuning range, the inductance of the oscillator tuned circuit is too low and the series padding capacity is too high. In such cases, an inductance re-adjustment should be made first to provide correct tracking from the high frequency end to the mid-point of the tuning range and only after the circuit inductance appears to be correct should the series padding capacitor be re-adjusted, or a decision be made regarding the necessity for replacing it.

There are several possible incorrect combinations of inductance and series padding capacity other than those mentioned above but, in all cases, the principles of test and adjustment are the same.

After any change or re-adjustment is made to either the high frequency oscillator circuit inductance or series padding capacity, it will be necessary to re-align the high frequency oscillator trimmer Number 5, as described under Par. 14.33. Tracking may then be re-checked.

## 15. PARTS LISTS

### 15.1 LIST OF MAJOR UNITS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

| *Navy Type Designation* | *Name* | *Symbol Designation Group* |
|---|---|---|
| CNA-46080 | RADIO RECEIVER | 101–199 |
| CNA-20089 | POWER UNIT | 201–299 |
| CNA-20090 | POWER UNIT | 201–299 |
| CNA-49105 | LOUD SPEAKER | 301–399 |
| CNA-49106 | LOUD SPEAKER | 301–399 |
| CNA-47156 | COIL SET 1 | 401–499 |
| CNA-47157 | COIL SET 2 | 501–599 |
| CNA-47158 | COIL SET 3 | 601–699 |
| CNA-47159 | COIL SET 4 | 701–799 |
| CNA-47160 | COIL SET 5 | 801–899 |
| CNA-47161 | COIL SET 6 | 901–999 |
| CNA-47162 | COIL SET 7 | 1001–1099 |
| CNA-10037 | COIL SYSTEM CONTAINER | 1101–1199 |
| CNA-10036 | MOUNTING RACK | 1201–1299 |

## 15.2 TABLE I
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 1
### TYPE CNA-46080 RADIO RECEIVER UNIT (101-199)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURAL PARTS | | | | | | |
| A-101 | | Eccentric Coil Set Latch | Coil Set Latch, Left | ..... | ..... | 8 | CSL-L | | C-233/234 |
| A-102 | | Eccentric Coil Set Latch | Coil Set Latch, Right | ..... | ..... | 8 | CSL-R | | C-233/234 |
| | | | CAPACITORS | | | | | | |
| C-101 | | Main Tuning | Variable Air: 4 gang, 12 to 225 mmf. per section ± 10% | ..... | ..... | 8 | PW4 | | C-218 |
| | A | First R.F. Amp. Tuning | | | | | | | |
| | B | Second R.F. Amp. Tuning | | | | | | | |
| | C | First Detector Tuning | | | | | | | |
| | D | H.F. Oscillator Tuning | | | | | | | |
| *C-102 | | V-101 Grid Filter | Mica: .001 mfd. ± 10%, 500 V DC W | CAW-48983-10 | RE 48AA 143D | 1 | 1467 | | |
| *C-103 | | V-101 Grid Filter | Mica: .005 mfd. ± 10%, 300 V DC W | CAW-481037-10 | RE 48A 143 | 1 | 1467 | | |
| *C-104 | | V-101 Cathode By-pass | Paper: .1 mfd. +20-10%, 400 V DC W | CAW-481073 | RE 13A 488C | 1 | 489 | | |
| *C-105 | | V-101 and V-102 Screen By-pass | Paper: .1 mfd. +20-10%, 600 V DC W | CAW-481075 | RE 13A 488C | 1 | 689 | | |
| *C-106 | | V-101 B+ By-pass | Same as C-105 | CAW-481075 | ..... | | | | |
| *C-107 | | V-102 Grid Filter | Paper: .01 mfd. +20-10%, 400 V DC W | CAW-481072 | RE 13A 488C | 1 | 489 | | |
| *C-108 | | V-102 Cathode By-pass | Same as C-104 | CAW-481073 | ..... | | | | |
| *C-109 | | V-104 Grid | Mica: .0001 mfd. ± 10%, 500 V DC W | CAW-481042-10 | ..... | 1 | 1465 | | |
| *C-110 | | V-104 to V-103 Coupling | Mica: .01 mfd. ± 10%, 300 V DC W | CAW-48848-10 | RE 48A 143A | 1 | 1467 | | |
| *C-111 | | V-104 Screen By-pass | Same as C-105 | CAW-481075 | ..... | | | | |
| *C-112 | | V-102 B+ By-pass | Same as C-105 | CAW-481075 | ..... | | | | |
| *C-113 | | V-103 Cathode By-pass | Same as C-104 | CAW-481073 | ..... | | | | |
| *C-114 | | V-103 B+ By-pass | Same as C-105 | CAW-481075 | ..... | | | | |
| C-115 | | T-101 Primary Tuning | Variable Air: 6 to 85 mmf. ± 10% | ..... ..... | ..... | 8 | | | |
| C-116 | | T-101 Secondary Tuning | Same as C-115 | ..... | ..... | | | | |
| *C-117 | | V-105 Grid Filter | Same as C-107 | CAW-481072 | ..... | | | | |
| *C-118 | | V-105 Cathode By-pass | Same as C-104 | CAW-481073 | ..... | | | | |
| *C-119 | | V-105 and V-106 Screen By-pass | Paper: 1 mfd. +20 −10%, 400 V DC W | °-48286A | °RE 48AA 129C | 1 | 461 | | |
| *C-120 | | V-105 and V-106 B+ By-pass | Paper: .25 mfd. +20 −10%, 600 V DC W | CAW-481076 | RE 13A 488C | 1 | 689 | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.
° Assignment for REPLACEMENT USE ONLY.

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 1 (*Continued*)
### TYPE CNA-46080 RADIO RECEIVER UNIT (101-199)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | CAPACITORS (*Continued*) | | | | | | |
| C-121 | | T-102 Primary Tuning | Same as C-115 | ..... | ..... | | | | |
| C-122 | | T-102 Secondary Tuning | Same as C-115 | ..... | ..... | | | | |
| *C-123 | | V-106 Grid Filter | Same as C-107 | CAW-481072 | ..... | | | | |
| *C-124 | | B+ By-pass | Same as C-102 | CAW-48983-10 | ..... | | | | |
| ✓ *C-125 | | V-108 Heater By-pass | Same as C-104 | CAW-481073 | ..... | | | | |
| C-126 | | C. W. Osc. Vernier | Variable Air: 8 to 120 mmf. ± 10% | ..... | ..... | 8 | CWO-120 | | C-284 |
| *C-127 | | V-108 Screen By-pass | Same as C-104 | CAW-481073 | ..... | | | | |
| ✓ *C-128 | | V-108 to V-107A Coupling | Bakelite: 2 mmf. 400 V DC W | ..... | ..... | 8 | B22 | | C-279 |
| ✓ *C-129 | | V-106 Cathode By-pass | Same as C-104 | CAW-481073 | ..... | | | | |
| *C-130 | | V-107B Plate By-pass | Same as C-107 | CAW-481072 | ..... | | | | |
| C-131 | | T-104 Primary Tuning | Same as C-115 | ..... | ..... | | | | |
| C-132 | | T-104 Secondary Tuning | Same as C-115 | ..... | ..... | | | | |
| *C-133 | | V-105 Heater By-pass | Same as C-104 | CAW-481073 | ..... | | | | |
| *C-134 | | V-107A Cathode By-pass | Electrolytic: 10 mfd. 50 V DC W | CD-481044 | ..... | 3 | FA10025 | | |
| *C-135 | | V-107A Plate I.F. Filter | Same as C-102 | CAW-48983-10 | ..... | | | | |
| *C-136 | | V-107A Plate Audio Filter | Same as C-120 | CAW-481076 | ..... | | | | |
| *C-137 | | V-107A Plate I.F. Filter | Mica: .0005 mfd. ± 10%, 500 V DC W | CAW-481043-10 | RE 48AA 143 | 1 | 1467 | | |
| ✓ *C-138 | | B Minus to Chassis By-pass | Paper: .25 mfd. +20 −10%, 400 V DC W | CAW-481074 | RE 13A 488C | 1 | 489 | | |
| *C-139 | | V-107A to V-109 Coupling | Same as C-105 | CAW-481075 | ..... | | | | |
| *C-140 | | T-104 to V-107B Coupling | Mica: .00025 mfd. ±10%, 500 V DC W | CAW-48690-10 | RE 48A 148A | 1 | 1468 | | |
| *C-141 | | V-107B Cathode By-pass | Same as C-104 | CAW-481073 | ..... | | | | |
| *C-142 | | V-109 Heater By-pass | Same as C-107 | CAW-481072 | ..... | | | | |
| *C-143 | | B+ By-pass | Same as C-120 | CAW-481076 | ..... | | | | |
| C-144 | | T-103 Tuning | Same as C-115 | ..... | ..... | | | | |
| ✓ C-145 | | T-103 Tuning | Same as C-115 | ..... | ..... | | | | |
| ✓ C-146 | | V-108 Grid | Mica: .001 mfd. ± 10%, 500 V DC W | °[1]-48695-10 | ..... | 1 | 1460 | | |
| *C-147 | | V-109 Cathode By-pass | Electrolytic: 25 mfd., 50 V DC W | CD-481045 | ..... | 3 | FA10062 | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.
° Assignment for REPLACEMENT USE ONLY.
[1] Assignment for Mfr. Desig. 1461.

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 1 (*Continued*)
### TYPE CNA-46080 RADIO RECEIVER UNIT (101-199)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | MISCELLANEOUS ELECTRICAL PARTS | | | | | | |
| E-101 | | Antenna Input Terminals | Insulated Binding Post Assembly | ..... | ..... | 8 | FWK | | B833/573 |
| E-102 | | First R.F. Trans. Connectors | Contact Spring Assembly | ..... | ..... | 8 | SCF | 5 Springs | |
| E-103 | | Second R.F. Trans. Connectors | Same as E-102 | ..... | ..... | | | | |
| E-104 | | First Det. Trans. Connectors | Same as E-102 | ..... | ..... | | | | |
| E-105 | | H.F. Osc. Trans. Connectors | Contact Spring Assembly | ..... | ..... | 8 | SCF | 4 Springs | |
| E-106 | | S-103 Terminals | Insulated Screw Terminals | ..... | ..... | 12 | 1720 | BSW | |
| E-107 | | Loud Speaker Output | Insulated Tip Jacks | ..... | ..... | 12 | 1490 | SPKR | |
| E-108 | | W-201 Shield Ground | Screw Terminal | ..... | ..... | 8 | HC-LUG | | |
| E-109 | | V-101 Shield | Aluminum Tube Shield | ..... | ..... | 8 | T78 | | |
| E-110 | | V-102 Shield | Same as E-109 | ..... | ..... | | | | |
| E-111 | | V-103 Shield | Same as E-109 | ..... | ..... | | | | |
| E-112 | | V-104 Shield | Same as E-109 | ..... | ..... | | | | |
| E-113 | | V-105 Shield | Same as E-109 | ..... | ..... | | | | |
| E-114 | | V-106 Shield | Same as E-109 | ..... | ..... | | | | |
| E-115 | | V-107 Shield | Same as E-109 | ..... | ..... | | | | |
| E-116 | | V-108 Shield | Same as E-109 | ..... | ..... | | | | |
| E-117 | | V-109 Shield | Aluminum Tube Shield | ..... | ..... | 8 | TS | | |
| E-118 | | J-101 Shield | Aluminum Baffle | ..... | ..... | 8 | RAS-AB | | |
| E-119 | | Socket for I-101 | Pilot Lamp Socket Assembly | ..... | ..... | 10 | B310RR | | |
| | | | INDICATING DEVICES | | | | | | |
| I-101 | | Pilot Lamp | 6.3V., .25A. Bayonet Base | ..... | ..... | 4 | 44 | | |
| | | | JACKS AND RECEPTACLES | | | | | | |
| J-101 | | Headphone Output | Multi-Circuit Jack | ..... | ..... | 10 | 705B | 14228 | |
| | | | NAMEPLATES AND DIALS | | | | | | |
| N-101 | | Main Tuning Dial | Multi-Revolution, 0-500 Div. | ..... | ..... | 8 | PW-DN | | |
| N-102 | | R-115 Knob | Etched Dial "R.F. GAIN" | ..... | ..... | 8 | HRO-DIAL | R.F. GAIN | B-320A-2 |
| N-103 | | C-126 Knob | Etched Dial "C.W. OSC." | ..... | ..... | 8 | HRO-DIAL | C.W. OSC. | B-320A-3 |
| N-104 | | R-136 Knob | Etched Dial "A.F. GAIN" | ..... | ..... | 8 | HRO-DIAL | A.F. GAIN | B-320A-1 |
| N-105 | | Radio Receiver Nameplate | Etched, German Silver | ..... | ..... | 8 | RNP-S | | C-287 |

# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)

## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 1 (*Continued*)

### TYPE CNA-46080 RADIO RECEIVER UNIT (101-199)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **PLUGS** | | | | | | |
| P-101 | | Power Supply Cable Connector | 4 Prong with Rubber Cap | ..... | ..... | 8 | PCP-4 | | |
| | | | **RESISTORS** | | | | | | |
| *R-101 | | V-101 Grid Filter | 500,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-102 | | V-101 Cathode Bias | 300 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-103 | | V-102 Grid Filter | Same as R-101 | CBN-63360 | ..... | | | | |
| *R-104 | | V-102 Cathode Bias | Same as R-102 | CBN-63360 | ..... | | | | |
| *R-105 | | V-104 Grid Leak | 20,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-106 | | V-101 and V-102 Screen Filter | 5,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-107 | | V-103 Screen Filter | 100,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-108 | | V-104 Screen Dropping | 25,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-109 | | V-104 Screen Bleeder | Same as R-107 | CBN-63360 | ..... | | | | |
| *R-110 | | V-103 Cathode Bias | Same as R-106 | CBN-63360 | ..... | | | | |
| *R-111 | | V-103 Plate Filter | 2,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-112 | | V-105 Grid Filter | Same as R-101 | CBN-63360 | ..... | | | | |
| R-113 | | T-101 Secondary Load | 1 Megohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-114 | | V-105 Cathode Bias | Same as R-102 | CBN-63360 | ..... | | | | |
| *R-115 | | R.F. Gain Control | 10,000 Ohm, 1.5 Watt, Wire Wound Variable | CMC-63756 | RE 13A 492 | 7 | P58-10,000U | | |
| *R-116 | | Voltage Divider | 30,000 Ohm ±10%, 2 Watt | CBN-63474 | RE 13A 372G | 2 | 316 | | |
| *R-117 | | Screen Circuit Volt. Divider | 15,000 Ohm ±10%, 2 Watt | CBN-63474 | RE 13A 372G | 2 | 316 | | |
| *R-118 | | V-105 and V-106 Plate Filter | Same as R-111 | CBN-63360 | ..... | | | | |
| R-119 | | V-108 Grid Leak | 50,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-120 | | V-108 Screen Bleeder | Same as R-107 | CBN-63360 | ..... | | | | |
| *R-121 | | V-108 Screen Dropping | Same as R-107 | CBN-63360 | ..... | | | | |
| *R-122 | | V-108 Plate Filter | 250,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-123 | | V-106 Grid Filter | Same as R-101 | CBN-63360 | ..... | | | | |
| R-124 | | T-102 Secondary Load | Same as R-113 | CBN-63360 | ..... | | | | |
| *R-125 | | V-106 Cathode Bias | 1,500 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-126 | | A.V.C. Filter | Same as R-101 | CBN-63360 | ..... | | | | |
| *R-127 | | V-107B Plate | Same as R-107 | CBN-63360 | ..... | | | | |
| *R-128 | | V-107B Grid Leak | Same as R-101 | CBN-63360 | ..... | | | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 1 (*Continued*)
### TYPE CNA-46080 RADIO RECEIVER UNIT (101-199)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **RESISTORS (*Continued*)** | | | | | | |
| *R-129 | | V-107B Cathode Bias | 250 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-130 | | V-107B Voltage Divider | 1,000 Ohm ±10%, 2 Watt | CBN-63474 | RE 13A 372G | 2 | 316 | | |
| *R-131 | | V-107B Voltage Divider | Same as R-130 | CBN-63474 | ..... | | | | |
| *R-132 | | V-107A Cathode Bias | Same as R-105 | CBN-63360 | ..... | | | | |
| *R-133 | | V-107A Plate Audio Filter | 50,000 Ohm ±10%, 1 Watt | CBN-63288 | RE 13A 372G | 2 | 314 | | |
| *R-134 | | V-107A Plate | Same as R-105 | CBN-63360 | ..... | | | | |
| *R-135 | | V-107A Plate I.F. Filter | 10,000 Ohm ±10%, ½ Watt | CBN-63360 | RE 13A 372G | 2 | 310 | | |
| *R-136 | | Audio Gain Control | 500,000 Ohm, 1 Watt Composition Variable | CBN-63757 | ..... ..... | 2 | 72-105 | | |
| *R-137 | | V-109 Cathode Bias | 250 Ohm ±10%, 2 Watt | CBN-63474 | RE 13A 372G | 2 | 316 | | |
| *R-138 | | T-105 Primary Load | Same as R-102 | CBN-63360 | ..... | | | | |
| *R-139 | | Heater Center Tap | 64 Ohm C.T., 3 Watt | CYM-63751 | ..... | 10 | 864C | | |
| | | | **SWITCHES** | | | | | | |
| S-101 | | CW Oscillator ON-OFF | SPST, 1 Amp. 250 Volt | CHH-24070 | ..... | 5 | 20994L | | |
| S-102 | | A.V.C. ON-OFF | SPST, 1 Amp. 250 Volt | °-24000 | °RE 24AA 118 | 5 | 20992V | | |
| S-103 | | B+ ON-OFF | Same as S-102 | °-24000 | ..... | | | | |
| | | | **TRANSFORMERS** | | | | | | |
| *T-101 | | V-103 to V-105 I.F. Coupling | 175 Kc. | ..... | ..... | 8 | IFC-88 | | |
| *T-102 | | V-105 to V-106 I.F. Coupling | Same as T-101 | ..... | ..... | | | | |
| *T-103 | | CW Oscillator Tuning | 175 Kc. | ..... | ..... | 8 | IFCO-2 | | |
| *T-104 | | V-106 to V-107A I.F. Coupling | 175 Kc. | ..... | ..... | 8 | IFC-89 | | |
| *T-105 | | Audio Output Coupling | | CNA-30497 | ..... | 8 | F-600A | | C-285 |
| | | Primary (Black Leads) | 1340 Turns #29 D.C. Res: 40 Ohms ±10% | | | | | Impedance: 600 Ohms ±10% Sec. Load 600 Ohms ±10% | |
| | | Secondary (Yellow Leads) | 1340 Turns (Total) #29 C.T. D.C. Res: C.T. to Inside 25 Ohms ±10%, C.T. to Outside 30 Ohms ±10% | | | | | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.
° Assignment for REPLACEMENT USE ONLY.

## 15.2 TABLE I (*Continued*)

## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 1 (*Continued*)

### TYPE CNA-46080 RADIO RECEIVER UNIT (101-199)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **VACUUM TUBES** | | | | | | |
| *V-101 | | First R.F. Amplifier | R.F. Pentode | CRC-38646 | RE 13A 600B | 9 | 6D6 | | |
| *V-102 | | Second R.F. Amplifier | Same as V-101 | CRC-38646 | ..... | | | | |
| *V-103 | | First Detector | R.F. Pentode | CRC-38636 | RE 13A 600B | 9 | 6C6 | | |
| *V-104 | | H.F. Oscillator | Same as V-103 | CRC-38636 | ..... | | | | |
| *V-105 | | First I.F. Amplifier | Same as V-101 | CRC-38646 | ..... | | | | |
| *V-106 | | Second I.F. Amplifier | Same as V-101 | CRC-38646 | ..... | | | | |
| *V-107 | | | Dual Triode | CRC-38768F | RE 13A 600B | 9 | 6F8G | | |
| | A | Second Detector | Part of V-107 | | | | | | |
| | B | Automatic Volume Control | Part of V-107 | | | | | | |
| *V-108 | | C.W. Oscillator | Same as V-103 | CRC-38636 | ..... | | | | |
| *V-109 | | Audio Amplifier | Beam Audio Output | ..... | ..... | 9 | 6V6G° | | |
| | | | **INTERCONNECTING CABLES** | | | | | | |
| W-101 | | B Supply and Heater Cable | 4 Wire Shielded Cable | ..... | ..... | 8 | HRON-PC | | |
| | | | **SOCKETS** | | | | | | |
| X-101 | | Socket for V-101 | 6 Prong Ceramic | CNA-38357 | ..... | 8 | CIR-6 | | C-266 |
| X-102 | | Socket for V-102 | Same as X-101 | CNA-38357 | ..... | | | | |
| X-103 | | Socket for V-103 | Same as X-101 | CNA-38357 | ..... | | | | |
| X-104 | | Socket for V-104 | Same as X-101 | CNA-38357 | ..... | | | | |
| X-105 | | Socket for V-105 | Same as X-101 | CNA-38357 | ..... | | | | |
| X-106 | | Socket for V-106 | Same as X-101 | CNA-38357 | ..... | | | | |
| X-107 | | Socket for V-107 | Same as X-101 | CNA-38357 | ..... | | | | |
| X-108 | | Socket for V-108 | 8 Prong Ceramic | CNA-38358 | ..... | 8 | CIR-8 | | C-268 |
| X-109 | | Socket for V-109 | Same as X-108 | CNA-38358 | ..... | | | | |

### SECTION 2

### TYPES CNA-20089 AND CNA-20090 POWER UNITS (201-299)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **STRUCTURAL PARTS** | | | | | | |
| A-201 | | V-201 Compartment Cover | Framed Grille | ..... | ..... | 8 | SPU-CG | | C-308 |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.
° 6V6GT may be substituted.

## 15.2 TABLE I (*Continued*)

## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 2 (*Continued*)

### TYPES CNA-20089 AND CNA-20090 POWER UNITS (201-299)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **CAPACITORS** | | | | | | |
| C-201 | | Line By-pass, Part of T-201 | Mica: .01 mfd. ±10%, 600 V DCW | CAW-481046-10 | ..... | 1 | 1450 | | |
| C-202 | | B+ By-pass, Part of T-201 | Same as C-201 | CAW-481046-10 | ..... | | | | |
| *C-203 | | Input Filter | Paper: 4 mfd., 600 V DC W | CD-481080 | ..... | 3 | TLAD6040 | | |
| *C-204 | | Input Filter | Same as C-203 | CD-481080 | ..... | | | | |
| *C-205 | | Output Filter | Same as C-203 | CD-481080 | ..... | | | | |
| *C-206 | | Output Filter | Same as C-203 | CD-481080 | ..... | | | | |
| | | | **MISCELLANEOUS ELECTRICAL PARTS** | | | | | | |
| E-201 | | W101 Shield Ground | Knurled Head Screw | ..... | ..... | 8 | KHS | 3/8"-6/32 | |
| | | | **FUSES** | | | | | | |
| *F-201 | | A.C. Line Fuse | 1 Amp. Glass Enclosed | ..... | ..... | 6 | 3AG | | |
| *F-202 | | A.C. Line Fuse | Same as F-201 | ..... | ..... | | | | |
| | | | **JACKS AND RECEPTACLES** | | | | | | |
| J-201 | | A.C. Power Input | Motor Plug Cap | ..... | ..... | 5 | 7302 | | |
| J-202 | | B Supply and Heater | 4 Prong Socket | ..... | ..... | 12 | X18 | | |
| J-203 | | Fuse Holder | Fuse Clip Mounting | ..... | ..... | 6 | 1068 | | |
| | | | **INDUCTORS** | | | | | | |
| *L-201 | | B+ Filter | 5000 Turns #31. D.C. Resistance, 300 Ohms ±10% | CNA-30500 | ..... | 8 | J4373C | 17 Henry ± 20% .08 Amp. | C-327 |
| | | | **NAMEPLATES AND DIALS** | | | | | | |
| [1]N-201 | | Power Unit Nameplate | Etched, German Silver | ..... | ..... | 8 | PUNP-60 | | C-289 |
| [2]N-201 | | Power Unit Nameplate | Etched, German Silver | ..... | ..... | 8 | PUNP-25 | | C-290 |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.
[1] Used only with CNA-20090 Power Unit.
[2] Used only with CNA-20089 Power Unit.

## 15.2 TABLE I (*Continued*)

## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 2 (*Continued*)

### TYPES CNA-20089 AND CNA-20090 POWER UNITS (201-299)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **PLUGS** | | | | | | |
| P-201 | | A.C. Connector | 2 Prong, 660 W., 250 V. | ..... | ..... | 13 | 150 | | |
| P-202 | | W-201 Connector | Cord Connector Body | ..... | ..... | 5 | 7054 | | |
| | | | **SWITCHES** | | | | | | |
| S-201 | | A.C. Power Input | SPST Toggle, 1A., 250 V. | °-24000 | ..... | 5 | 20994AC | | |
| | | | **TRANSFORMERS** | | | | | | |
| [1]*T-201 | | Power Transformer | 110/120 Volt, 50/60 Cycle | CNA-30498 | ..... | 8 | 12069C | 75 VA. | C-301 |
| | | Primary: (Terminals 1 and 2) | 600 Turns #24. D.C. Resistance: 8 Ohms ±10% | | | | | 115 V, .65 A ±10%. | |
| | | ½ H.V. Secondary: (Terminals 3 and 4) | 1700 Turns #35. D.C. Resistance: 380 Ohms ±10%. | | | | | 280 V AC, .035 A ±10%. | |
| | | ½ H.V. Secondary: (Terminals 4 and 5) | 1700 Turns #35. D.C. Resistance: 420 Ohms ±10%. | | | | | 280 V AC, .035 A ±10%. | |
| | | V-201 Fil. Secondary: (Terminals 6 and 7) | 28 Turns #17. D.C. Resistance: .12 Ohms ±10%. | | | | | 5 V AC, 3 A ±10%. | |
| | | Heater Secondary: (Terminals 8 and 9) | 36 Turns #16. D.C. Resistance: .13 Ohms ±10%. | | | | | 6.2 V AC, 3.4 A. ±10%. | |
| | | Electrostatic Shield: (Terminal G) | | | | | | | |
| | | Line By-pass: (Terminals 2 and G) | C-201, Part of T-201 | | | | | | |
| | | B+ By-pass: (Terminals 7 and G) | C-202, Part of T-201 | | | | | | |
| [2]*T-201 | | Power Transformer | 110/120 Volt, 25 Cycle | CNA-30499 | ..... | 8 | 12360C | 75 VA. | C-301 |
| | | Primary: (Terminals 1 and 2) | 900 Turns #24. D.C. Resistance: 13 Ohms ±10%. | | | | | 115 V AC, .65 A ±10%. | |
| | | ½ H.V. Secondary: (Terminals 3 and 4) | 2550 Turns #34. D.C. Resistance: 450 Ohms ±10%. | | | | | 280 V AC .035 A ±10%. | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.
° Assignment for REPLACEMENT USE ONLY.
[1] Used only with CNA-20090 Power Unit.
[2] Used only with CNA-20089 Power Unit.

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 2 (*Continued*)
### TYPES CNA-20089 AND CNA-20090 POWER UNITS (201-299)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | **TRANSFORMERS (*Continued*)** | | | | | | | |
| | | ½ H.V. Secondary: (Terminals 4 and 5)<br>V-201 Fil. Secondary: (Terminals 6 and 7)<br>Heater Secondary: (Terminals 8 and 9)<br>Electrostatic Shield: (Terminal G)<br>Line By-pass: (Terminals 2 and G)<br>B+ By-pass: (Terminals 7 and G) | 2550 Turns #34. D.C. Resistance: 500 Ohms ±10%.<br>45 Turns #16. D.C. Resistance: .15 Ohms ±10%.<br>59 Turns #16. D.C. Resistance: .22 Ohms ±10%.<br><br>C-201, Part of T-201<br><br>C-202, Part of T-201 | | | | | 280 V AC .035 A ±10%<br>5 V AC, 3 A ±10%.<br>6.2 V AC, 3.4 A ±10%. | |
| | | **VACUUM TUBES** | | | | | | | |
| V-201 | | Rectifier | Full Wave Rectifier | CRC-38593 | RE 13A 600B | 9 | 5Z3 | | |
| | | **INTERCONNECTING CABLES** | | | | | | | |
| W-201 | | A.C. Power Supply | 2 Wire Rubber Covered | ..... | ..... | 13 | POSJ | 8'-18/2 | |
| | | **SOCKETS** | | | | | | | |
| X-201 | | Socket for V-201 | 4 Prong Socket | ..... | ..... | 12 | X18 | 38593 | |
| | | **SECTION 3**<br>**TYPES CNA-49105 AND CNA-49106 LOUD SPEAKERS (301-399)** | | | | | | | |
| | | **NAMEPLATES AND DIALS** | | | | | | | |
| [3]N-301 | | Loud Speaker Nameplate | Etched, German Silver | ..... | ..... | 8 | LSNP-T | | C-292 |
| [4]N-301 | | Loud Speaker Nameplate | Etched, German Silver | ..... | ..... | 8 | LSNP-R | | C-291 |

# Symbol part designation, if any.
[3] Used only with Type CNA-49106 Loud Speaker.
[4] Used only with Type CNA-49105 Loud Speaker.

## 15.2 TABLE I (*Continued*)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

SECTION 3 (*Continued*)

TYPES CNA-49105 AND CNA-49106 LOUD SPEAKERS (301-399)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | TRANSFORMERS | | | | | | |
| *T-301 | | Audio Coupling | | CNA-30501 | ..... | 8 | 5537C | | C-295 |
| | | Primary: (Terminals 1 and 2) | 2300 Turns #36. D.C. Resistance 275 Ohms ±10%. | | | | | 5000 Ohms ±20% @ 400 Cycles, .045 Amps. D.C. | |
| | | Secondary: (Terminals 3 and 4) | 52 Turns #19. D.C. Resistance .16 Ohms ±10%. | | | | | 2.8 Ohms ±20% Sec. Load. | |
| | | | INTERCONNECTING CABLES | | | | | | |
| W-301 | | Speaker Cable | 2 Wire Shielded | ..... | ..... | 8 | | PM8-SC | |
| | | | LOUD SPEAKERS | | | | | | |
| LS-301 | | Loud Speaker Chassis | 8 Inch Size, P.M. Field | ..... | ..... | 11 | PMK-8 | | LS-301 |

## SECTION 4

TYPE CNA-47156 COIL SET 1 (401-499)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | CAPACITORS | | | | | | |
| C-401 | | T-401 Trimmer | Variable Air: 5 to 28 mmf. ±10%. | ..... | ..... | 8 | | | |
| C-402 | | T-402 Trimmer | Same as C-401 | ..... | ..... | | | | |
| C-403 | | T-403 Trimmer | Same as C-401 | ..... | ..... | | | | |
| C-404 | | T-404 Trimmer | Same as C-401 | ..... | ..... | | | | |
| C-405 | | T-404 Series Padding | Variable Air: 7 to 60 mmf. | ..... | ..... | 8 | | | |
| *C-406 | | T-404 Series Padding | Mica: .0003 mfd. ±3%, 500 V DC W | CAW-48854-3 | RE 48A 143 | 1 | 1467 | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.

\# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)

## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 4 (*Continued*)

### TYPE CNA-47156 COIL SET 1 (401-499)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **INDUCTORS** | | | | | | |
| L-401 | | T-401 Coil | | ..... | ..... | 8 | 95S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 2.5 Ohms ±15%. | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 14 Ohms ±15%. | | | | | | |
| L-402 | | T-402 Coil | | ..... | ..... | 8 | 42S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 225 Ohms ±15%. | | | | | | |
| L-403 | | T-402 Coil | | | | 8 | 96S-RF | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 14. Ohms ±15%. | | | | | | |
| L-404 | | T-403 Coil | | | | 8 | 96S-D | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .3 Ohms ±15%. | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 14 Ohms ±15%. | | | | | | |
| L-405 | | T-404 Coil | | ..... | ..... | 8 | 97N | | |
| | | Tap: (Terminals 4 and 5) | D.C. Resistance: 2.4 Ohms ±15%. | | | | | | |
| | | Total: (Terminals 2 and 4) | D.C. Resistance: 9 Ohms ±15%. | | | | | | |
| | | | **NAMEPLATES AND DIALS** | | | | | | |
| N-401 | | Coil Set 1 Nameplate | Etched, German Silver | ..... | ..... | 8 | CSNP-S1 | | C-241 |
| N-402 | | Calibration Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-S1 | | |
| N-403 | | Logging Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-SL | | |
| | | | **TRANSFORMERS** | | | | | | |
| T-401 | | E-101 to V-101 Coupling | R.F. Transformer Assembly, Coil Set 1 | ..... | ..... | 8 | G5E | | |
| T-402 | | V-101 to V-102 Coupling | R.F. Transformer Assembly, Coil Set 1 | ..... | ..... | 8 | G6E | | |
| T-403 | | V-102 to V-103 Coupling | R.F. Transformer Assembly, Coil Set 1 | ..... | ..... | 8 | G7E | | |
| T-404 | | H.F. Osc. Inductor Assembly | R.F. Transformer Assembly, Coil Set 1 | ..... | ..... | 8 | G8E | | |

# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)

## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 5

### TYPE CNA-47157 COIL SET 2 (501-599)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **CAPACITORS** | | | | | | |
| C-501 | | T-501 Trimmer | Variable Air: 6 to 38 mmf. ±10%. | ..... | ..... | 8 | | | |
| C-502 | | T-502 Trimmer | Same as C-501 | ..... | ..... | | | | |
| C-503 | | T-503 Trimmer | Same as C-501 | ..... | ..... | | | | |
| C-504 | | T-504 Trimmer | Same as C-501 | ..... | ..... | | | | |
| C-505 | | T-504 Series Padding | Variable Air: 8 to 68 mmf. ±10%. | ..... | ..... | 8 | | | |
| *C-506 | | T-504 Series Padding | Mica: .0007 mfd. ±3%, 500 V DC W | CAW-481016-3 | RE 48A 143 | 1 | 1467 | | |
| | | | **INDUCTORS** | | | | | | |
| L-501 | | T-501 Coil | | ..... | ..... | 8 | 91S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .8 Ohms ±15%. | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 4.5 Ohms ±15%. | | | | | | |
| L-502 | | T-502 Coil | | ..... | ..... | 8 | 1S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 44 Ohms ±15%. | | | | | | |
| L-503 | | T-502 Coil | | ..... | ..... | 8 | 98S | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 4.5 Ohms ±15%. | | | | | | |
| L-504 | | T-503 Coil | | ..... | ..... | 8 | 93S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .16 Ohms ±15%. | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 4.5 Ohms ±15%. | | | | | | |
| L-505 | | T-504 Coil | | ..... | ..... | 8 | 94S | | |
| | | Tap: (Terminals 4 and 5) | D.C. Resistance: 5 Ohms ±15%. | | | | | | |
| | | Total: (Terminals 2 and 4) | D.C. Resistance: 10 Ohms ±15%. | | | | | | |
| | | | **NAMEPLATES AND DIALS** | | | | | | |
| N-501 | | Coil Set 2 Nameplate | Etched, German Silver | ..... | ..... | 8 | CSNP-S2 | | C-241 |
| N-502 | | Calibration Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-S2 | | |
| N-503 | | Logging Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-SL | | |

*** SPARE PARTS FURNISHED refer to TABLE III for quantities.**
**# Symbol part designation, if any.**

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 5 (*Continued*)
### TYPE CNA-47157 COIL SET 2 (501-599)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **TRANSFORMERS** | | | | | | |
| T-501 | | E-101 to V-101 Coupling | R.F. Transformer Assembly, Coil Set 2. | ..... | ..... | 8 | F5E | | |
| T-502 | | V-101 to V-102 Coupling | R.F. Transformer Assembly, Coil Set 2. | ..... | ..... | 8 | F6E | | |
| T-503 | | V-102 to V-103 Coupling | R.F. Transformer Assembly, Coil Set 2. | ..... | ..... | 8 | F7E | | |
| T-504 | | H.F. Osc. Inductor Assembly | R.F. Transformer Assembly, Coil Set 2. | ..... | ..... | 8 | F8E | | |
| | | | **SECTION 6** | | | | | | |
| | | | **TYPE CNA-47158 COIL SET 3 (601-699)** | | | | | | |
| | | | **CAPACITORS** | | | | | | |
| C-601 | | T-601 Trimmer | Variable Air: 5 to 28 mmf. ±10%. | ..... | ..... | 8 | | | |
| C-602 | | T-602 Trimmer | Same as C-601 | ..... | ..... | | | | |
| C-603 | | T-603 Trimmer | Same as C-601 | ..... | ..... | | | | |
| C-604 | | T-604 Trimmer | Same as C-601 | ..... | ..... | | | | |
| C-605 | | T-604 Series Padding | Variable Air: 6 to 38 ±10% | ..... | ..... | 8 | | | |
| *C-606 | | T-604 Series Padding | Mica: .0012 mfd. ±3%, 500 V DC W | CAW-481084-3 | RE 48A 143 | 1 | 1467 | | |
| | | | **INDUCTORS** | | | | | | |
| L-601 | | T-601 Coil | | ..... | ..... | 8 | 126S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .6 Ohms ±15% | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 2.1 Ohms ±15% | | | | | | |
| L-602 | | T-602 Coil | | ..... | ..... | 8 | 117S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 25 Ohms ±15% | | | | | | |
| L-603 | | T-602 Coil | | ..... | ..... | 8 | 102S-RF | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 2.1 Ohms ±15% | | | | | | |
| L-604 | | T-603 Coil | | ..... | ..... | 8 | 102S-D | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .3 Ohms ±15% | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: 2.1 Ohms ±15% | | | | | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 6 (*Continued*)
### TYPE CNA-47158 COIL SET 3 (601-699)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | INDUCTORS (*Continued*) | | | | | | |
| L-605 | | T-604 Coil<br>Tap: (Terminals 4 and 5)<br>Total: (Terminals 2 and 4) | <br>D.C. Resistance: .6 Ohms ±15%<br>D.C. Resistance: 1.9 Ohms ±15% | ..... | ..... | 8 | 90S | | |
| | | | NAMEPLATES AND DIALS | | | | | | |
| N-601 | | Coil Set 3 Nameplate | Etched, German Silver | ..... | ..... | 8 | CSNP-S3 | | C-241 |
| N-602 | | Calibration Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-S3 | | |
| N-603 | | Logging Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-SL | | |
| | | | TRANSFORMERS | | | | | | |
| T-601 | | E-101 to V-101 Coupling | R.F. Transformer Assembly, Coil Set 3 | ..... | ..... | 8 | E5E | | |
| T-602 | | V-101 to V-102 Coupling | R.F. Transformer Assembly, Coil Set 3 | ..... | ..... | 8 | E6E | | |
| T-603 | | V-102 to V-103 Coupling | R.F. Transformer Assembly, Coil Set 3 | ..... | ..... | 8 | E7E | | |
| T-604 | | H.F. Osc. Inductor Assembly | R.F. Transformer Assembly, Coil Set 3 | ..... | ..... | 8 | E8E | | |
| | | | SECTION 7<br>TYPE CNA-47159 COIL SET 4 (701-799) | | | | | | |
| | | | CAPACITORS | | | | | | |
| C-701 | | T-701 Trimmer | Variable Air: 5 to 28 mmf. ±10% | ..... | ..... | 8 | | | |
| C-702 | | T-702 Trimmer | Same as C-701 | ..... | ..... | | | | |
| C-703 | | T-703 Trimmer | Same as C-701 | ..... | ..... | | | | |
| C-704 | | T-704 Trimmer | Same as C-701 | ..... | ..... | | | | |
| *C-705 | | T-705 Series Padding | Mica: .0026 mfd. ±3%, 500 V DC W | CAW-481085-3 | RE 48A 143 | 1 | 1467 | | |
| | | | INDUCTORS | | | | | | |
| L-701 | | T-701 Coil<br>Primary: (Terminals 4 and 5)<br>Secondary: (Terminals 1 and 3) | <br>D.C. Resistance: .6 Ohms ±15%<br>D.C. Resistance: .8 Ohms ±15% | ..... | ..... | 8 | D1S | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 7 (*Continued*)
### TYPE CNA-47159 COIL SET 4 (701-799)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | INDUCTORS (*Continued*) | | | | | | |
| L-702 | | T-702 Coil | | ..... | ..... | 8 | 116S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 13 Ohms ±15% | | | | | | |
| L-703 | | T-702 Coil | | ..... | ..... | 8 | D2S | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .8 Ohms ±15% | | | | | | |
| L-704 | | T-703 Coil | | ..... | ..... | 8 | 116S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 13 Ohms ±15% | | | | | | |
| L-705 | | T-703 Coil | | ..... | ..... | 8 | D3S | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .8 Ohms ±15% | | | | | | |
| L-706 | | T-704 Coil | | ..... | ..... | 8 | D4S | | |
| | | Tap: (Terminals 4 and 5) | D.C. Resistance: .17 Ohms ±15% | | | | | | |
| | | Total: (Terminals 2 and 4) | D.C. Resistance: .8 Ohms ±15% | | | | | | |
| | | | NAMEPLATES AND DIALS | | | | | | |
| N-701 | | Coil Set 4 Nameplate | Etched, German Silver | ..... | ..... | 8 | CSNP-S4 | | C-241 |
| N-702 | | Calibration Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-S4 | | |
| N-703 | | Logging Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-SL | | |
| | | | TRANSFORMERS | | | | | | |
| T-701 | | E-101 to V-101 Coupling | R.F. Transformer Assembly, Coil Set 4 | ..... | ..... | 8 | D5E | | |
| T-702 | | V-101 to V-102 Coupling | R.F. Transformer Assembly, Coil Set 4 | ..... | ..... | 8 | D6E | | |
| T-703 | | V-102 to V-103 Coupling | R.F. Transformer Assembly, Coil Set 4 | ..... | ..... | 8 | D7E | | |
| T-704 | | H.F. Osc. Inductor Assembly | R.F. Transformer Assembly, Coil Set 4 | ..... | ..... | 8 | D8E | | |

### SECTION 8
### TYPE CNA-47160 COIL SET 5 (801-899)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | CAPACITORS | | | | | | |
| C-801 | | T-801 Trimmer | Variable Air: 5 to 28 mmf. ±10% | ..... | ..... | 8 | | | |
| C-802 | | T-802 Trimmer | Same as C-801 | ..... | ..... | | | | |
| C-803 | | T-803 Trimmer | Same as C-801 | ..... | ..... | | | | |
| C-804 | | T-804 Trimmer | Same as C-801 | ..... | ..... | | | | |
| *C-805 | | T-804 Series Padding | Mica: .0051 mfd. ±3%, 300 V DC W | CAW-481086-3 | RE 48A 143 | 1 | 1467 | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)

## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 8 (*Continued*)

### TYPE CNA-47160 COIL SET 5 (801-899)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **INDUCTORS** | | | | | | |
| L-801 | | T-801 Coil | | ..... | ..... | 8 | C1S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .35 Ohms ±15% | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .2 Ohms ±15% | | | | | | |
| L-802 | | T-802 Coil | | ..... | ..... | 8 | 115S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 6 Ohms ±15% | | | | | | |
| L-803 | | T-802 Coil | | ..... | ..... | 8 | C2S | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .2 Ohms ±15% | | | | | | |
| L-804 | | T-803 Coil | | ..... | ..... | 8 | 115S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 6 Ohms ±15% | | | | | | |
| L-805 | | T-803 Coil | | ..... | ..... | 8 | C3S | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .2 Ohms ±15% | | | | | | |
| L-806 | | T-804 Coil | | ..... | ..... | 8 | C4S | | |
| | | Tap: (Terminals 4 and 5) | D.C. Resistance: .06 Ohms ±15% | | | | | | |
| | | Total: (Terminals 2 and 4) | D.C. Resistance: .2 Ohms ±15% | | | | | | |
| | | | **NAMEPLATES AND DIALS** | | | | | | |
| N-801 | | Coil Set 5 Nameplate | Etched, German Silver | ..... | ..... | 8 | CSNP-S5 | | C-241 |
| N-802 | | Calibration Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-S5 | | |
| N-803 | | Logging Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-SL | | |
| | | | **TRANSFORMERS** | | | | | | |
| T-801 | | E-101 to V-101 Coupling | R.F. Transformer Assembly, Coil Set 5 | ..... | ..... | 8 | C5E | | |
| T-802 | | V-101 to V-102 Coupling | R.F. Transformer Assembly, Coil Set 5 | ..... | ..... | 8 | C6E | | |
| T-803 | | V-102 to V-103 Coupling | R.F. Transformer Assembly, Coil Set 5 | ..... | ..... | 8 | C7E | | |
| T-804 | | H.F. Osc. Inductor Assembly | R.F. Transformer Assembly, Coil Set 5 | ..... | ..... | 8 | C8E | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)

## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 9

### TYPE CNA-47161 COIL SET 6 (901-999)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | Part No. National Co. Dwg. and |
|---|---|---|---|---|---|---|---|---|---|
| | | | **CAPACITORS** | | | | | | |
| C-901 | | T-901 Trimmer | Variable Air: 5 to 28 mmf. ±10% | ..... | ..... | 8 | | | |
| C-902 | | T-902 Trimmer | Same as C-901 | ..... | ..... | | | | |
| C-903 | | T-903 Trimmer | Same as C-901 | ..... | ..... | | | | |
| C-904 | | T-904 Trimmer | Same as C-901 | ..... | ..... | | | | |
| *C-905 | | T-904 Series Padding | Mica: .0088 mfd. ±3%, 300 V DC W | CAW-481087-3 | RE 48A 143 | 1 | 1467 | | |
| | | | **INDUCTORS** | | | | | | |
| L-901 | | T-901 Coil | | ..... | ..... | 8 | B1S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .27 Ohms ±15% | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .08 Ohms ±15% | | | | | | |
| L-902 | | T-902 Coil | | ..... | ..... | 8 | 114S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: 3 Ohms ±15% | | | | | | |
| L-903 | | T-902 Coil | | ..... | ..... | 8 | B2S | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .08 Ohms ±15% | | | | | | |
| L-904 | | T-903 Coil | | ..... | ..... | 8 | B3S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .2 Ohms ±15% | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .08 Ohms ±15% | | | | | | |
| L-905 | | T-904 Coil | | ..... | ..... | 8 | B4S | | |
| | | Tap: (Terminals 4 and 5) | D.C. Resistance: .06 Ohms ±15% | | | | | | |
| | | Total: (Terminals 2 and 4) | D.C. Resistance: .09 Ohms ±15% | | | | | | |
| | | | **NAMEPLATES AND DIALS** | | | | | | |
| N-901 | | Coil Set 6 Nameplate | Etched, German Silver | ..... | ..... | 8 | CSNP-S6 | | C-241 |
| N-902 | | Calibration Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-S6 | | |
| N-903 | | Logging Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-SL | | |
| | | | **TRANSFORMERS** | | | | | | |
| T-901 | | E-101 to V-101 Coupling | R.F. Transformer Assembly, Coil Set 6 | ..... | ..... | 8 | B5E | | |
| T-902 | | V-101 to V-102 Coupling | R.F. Transformer Assembly, Coil Set 6 | ..... | ..... | 8 | B6E | | |
| T-903 | | V-102 to V-103 Coupling | R.F. Transformer Assembly, Coil Set 6 | ..... | ..... | 8 | B7E | | |
| T-904 | | H.F. Osc. Inductor Assembly | R.F. Transformer Assembly, Coil Set 6 | ..... | ..... | 8 | B8E | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT
### SECTION 10
### TYPE CNA-47162 COIL SET 7 (1001-1099)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **CAPACITORS** | | | | | | |
| C-1001 | | T-1001 Trimmer | Variable Air: 5 to 28 mmf. ±10% | ..... | ..... | 8 | | | |
| *C-1002 | | T-1001 Series Padding | Mica: .0012 mfd. ±3%, 500 V DC W | CAW-481084-3 | RE 48A 143 | 1 | 1467 | | |
| *C-1003 | | T-1001 Primary Series | Mica: .00004 mfd. ±10%, 500 V DC W | CAW-481077-10 | RE 48A 148 | 1 | 1468 | | |
| C-1004 | | T-1002 Trimmer | Same as C-1001 | ..... | ..... | | | | |
| C-1005 | | T-1003 Trimmer | Same as C-1001 | ..... | ..... | | | | |
| C-1006 | | T-1004 Trimmer | Same as C-1001 | ..... | ..... | | | | |
| *C-1007 | | T-1004 Series Padding | Mica: .001 mfd. ±3%, 500 V DC W | CAW-48983-3 | RE 48A 143 | 1 | 1467 | | |
| | | | **INDUCTORS** | | | | | | |
| L-1001 | | T-1001 Coil | | ..... | ..... | 8 | A1S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: Inf. | | | | | | |
| | | Secondary: (Terminals 1 and 3) | D.C. Resistance: .04 Ohms ±15% | | | | | | |
| L-1002 | | T-1002 Coil | | ..... | ..... | 8 | A2S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .8 Ohms ±15% | | | | | | |
| | | Tuned Secondary: (Terminals 2 and 3) | D.C. Resistance: .06 Ohms ±15% | | | | | | |
| | | Aperiodic Secondary: (Terminals 1 and 3) | D.C. Resistance: 6 Ohms ±15% | | | | | | |
| L-1003 | | T-1003 Coil | | ..... | ..... | 8 | A3S | | |
| | | Primary: (Terminals 4 and 5) | D.C. Resistance: .8 Ohms ±15% | | | | | | |
| | | Tuned Secondary: (Terminals 2 and 3) | D.C. Resistance: .06 Ohms ±15% | | | | | | |
| | | Aperiodic Secondary: (Terminals 1 and 3) | D.C. Resistance: 6 Ohms ±15% | | | | | | |
| L-1004 | | T-1004 Coil | | ..... | ..... | 8 | A4S | | |
| | | Tap: (Terminals 4 and 5) | D.C. Resistance: .03 Ohms ±15% | | | | | | |
| | | Total: (Terminals 2 and 4) | D.C. Resistance: .07 Ohms ±15% | | | | | | |
| | | | **NAMEPLATES AND DIALS** | | | | | | |
| N-1001 | | Coil Set 7 Nameplate | Etched, German Silver | ..... | ..... | 8 | CSNP-S7 | | C-241 |
| N-1002 | | Calibration Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-S7 | | |
| N-1003 | | Logging Chart and Frame | Framed Chart Assembly | ..... | ..... | 8 | NCF-SL | | |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.

## 15.2 TABLE I (*Continued*)
## PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

### SECTION 10 (*Continued*)
### TYPE CNA-47162 COIL SET 7 (1001-1099)

| Symbol Desig. | # | FUNCTION | DESCRIPTION | Navy Type Desig. | Navy Dwg.-Spec. Number | MFR. | MFR. Desig. | Special Tolerance Rating or Modification | National Co. Dwg. and Part No. |
|---|---|---|---|---|---|---|---|---|---|
| | | | **TRANSFORMERS** | | | | | | |
| T-1001 | | E-101 to V-101 Coupling | R.F. Transformer Assembly, Coil Set 7 | ..... | ..... | 8 | A5E | | |
| T-1002 | | V-101 to V-102 Coupling | R.F. Transformer Assembly, Coil Set 7 | ..... | ..... | 8 | A6E | | |
| T-1003 | | V-102 to V-103 Coupling | R.F. Transformer Assembly, Coil Set 7 | ..... | ..... | 8 | A7E | | |
| T-1004 | | H.F. Osc. Inductor Assembly | R.F. Transformer Assembly, Coil Set 7 | ..... | ..... | 8 | A8E | | |

### SECTION 11
### TYPE CNA-10037 COIL SYSTEM CONTAINER (1101-1199)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **STRUCTURAL PARTS** | | | | | | |
| A-1101 | | Coil Container Cover Latch | Cupboard Catch | ..... | ..... | 14 | B11270 | Black | |
| | | | **NAMEPLATES AND DIALS** | | | | | | |
| N-1101 | | Coil System Container Nameplate | Etched, German Silver | ..... | ..... | 8 | CCNP | | C-293 |
| [1]N-1102 | | Equipment Nameplate | Etched, German Silver | ..... | ..... | 8 | ENP-S60 | | C-281 |
| [2]N-1102 | | Equipment Nameplate | Etched, German Silver | ..... | ..... | 8 | ENP-S25 | | C-282 |
| N-1103 | | Acceptance Nameplate | Etched, German Silver | ..... | ..... | 8 | ANP-N | | B-745 |

### SECTION 12
### TYPE CNA-10036 MOUNTING RACK (1201-1299)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **NAMEPLATES AND DIALS** | | | | | | |
| N-1201 | | Mounting Rack Nameplate | Etched, German Silver | ..... | ..... | 8 | MRNP | | C-294 |

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.
[1] Used only with CNA-20090 Power Unit.
[2] Used only with CNA-20089 Power Unit.

## 15.3 TABLE II

## PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

| | | | |
|---|---|---|---|
| RADIO RECEIVER | (101-199) | COIL SET 4 | (701-799) |
| POWER UNITS | (201-299) | COIL SET 5 | (801-899) |
| LOUD SPEAKERS | (301-399) | COIL SET 6 | (901-999) |
| COIL SET 1 | (401-499) | COIL SET 7 | (1001-1099) |
| COIL SET 2 | (501-599) | COIL SYSTEM CONTAINER | (1101-1199) |
| COIL SET 3 | (601-699) | MOUNTING RACK | (1201-1299) |

| Quantity | Navy Type No. | All Symbol Designations Involved | Description |
|---|---|---|---|
| | | MISCELLANEOUS (CLASS 10) | |
| 1 | ..... | A-101 | Coil Set Latch, Left |
| 1 | ..... | A-102 | Coil Set Latch, Right |
| 1 | ..... | A-201 | Framed Grille Cover |
| 1 | ..... | A-1101 | Cupboard Catch |
| 1 | ..... | E-101 | Insulated Binding Posts |
| 4 | ..... | E-102, 103, 104, 105 | Contact Spring Assembly |
| 1 | ..... | E-106 | Insulated Screw Terminals |
| 1 | ..... | E-107 | Insulated Tip Jacks |
| 1 | ..... | E-108 | Screw Terminal |
| 8 | ..... | E-109, 110, 111, 112, 113, 114, 115, 116 | Aluminum Tube Shield |
| 1 | ..... | E-117 | Aluminum Tube Shield |
| 1 | ..... | E-118 | Aluminum Baffle |
| 1 | ..... | E-119 | Pilot Lamp Socket Assembly |
| 1 | ..... | E-201 | Knurled Head Screw |
| 1 | ..... | I-101 | 6.3V.,.25A. Bayonet Base Lamp |
| 1 | ..... | N-101 | Multi-Revolution, 0-500 Dial |
| 1 | ..... | N-102 | Etched Dial "R.F. Gain" |
| 1 | ..... | N-103 | Etched Dial "C.W. Osc." |
| 1 | ..... | N-104 | Etched Dial "A.F. Gain" |
| 1 | ..... | N-105 | Radio Receiver Nameplate |
| 1 | ..... | [1]N-201 | Power Unit Nameplate |
| 1 | ..... | [2]N-201 | Power Unit Nameplate |
| 1 | ..... | [3]N-301 | Loud Speaker Nameplate |
| 1 | ..... | [4]N-301 | Loud Speaker Nameplate |
| 1 | ..... | N-401 | Coil Set 1 Nameplate |
| 1 | ..... | N-501 | Coil Set 2 Nameplate |
| 1 | ..... | N-601 | Coil Set 3 Nameplate |
| 1 | ..... | N-701 | Coil Set 4 Nameplate |
| 1 | ..... | N-801 | Coil Set 5 Nameplate |
| 1 | ..... | N-901 | Coil Set 6 Nameplate |
| 1 | ..... | N-1001 | Coil Set 7 Nameplate |
| 1 | ..... | N-402 | Framed Chart Assembly |
| 1 | ..... | N-502 | Framed Chart Assembly |
| 1 | ..... | N-602 | Framed Chart Assembly |
| 1 | ..... | N-702 | Framed Chart Assembly |
| 1 | ..... | N-802 | Framed Chart Assembly |
| 1 | ..... | N-902 | Framed Chart Assembly |
| 1 | ..... | N-1002 | Framed Chart Assembly |
| 7 | ..... | N-403, 503, 603, 703, 803, 903, 1003 | Framed Chart Assembly |
| 1 | ..... | N-1101 | Coil Container Nameplate |
| 1 | ..... | [1]N-1102 | Equipment Nameplate |
| 1 | ..... | [1]N-1102 | Equipment Nameplate |
| 1 | ..... | N-1103 | Acceptance Nameplate |
| 1 | ..... | N-1201 | Mounting Rack Nameplate |
| 1 | ..... | W-101 | 4 Wire Shielded Cable |
| 1 | ..... | W-201 | 2 Wire Rubber Covered Cable |
| 1 | ..... | W-301 | 2 Wire Shielded Cable |
| | | SWITCHES (CLASS 24) | |
| 1 | -24070 | S-101 | |
| 3 | °-24000 | S-102, 103, 201 | |
| | | FUSES (CLASS 28) | |
| 2 | ..... | F-201, 202 | 1 Amp. Glass Enclosed |
| | | A.F. REACTORS AND TRANSFORMERS (CLASS 30) | |
| 1 | -30500 | L-201 | |
| 1 | -30497 | T-105 | |
| 1 | -30498 | [1]T-201 | |
| 1 | -30499 | [2]T-201 | |
| 1 | -30501 | T-301 | |
| | | VACUUM TUBES AND SOCKETS (CLASS 38) | |
| 1 | -38593 | V-201 | |
| 3 | -38636 | V-103, 104, 108 | |
| 4 | -38646 | V-101, 102, 105, 106 | |
| 1 | -38768F | V-107 | |
| 1 | ..... | V-109 | Beam Audio Output |
| 7 | -38757 | X-101, 102, 103, 104, 105, 106, 107 | |

° Assignment for Replacement Use Only.
[1] Used only with Type CNA-20090 Power Unit.
[2] Used only with Type CNA-20089 Power Unit.
[3] Used only with Type CNA-49106 Loud Speaker.
[4] Used only with Type CNA-49105 Loud Speaker.

## 15.3 TABLE II (*Continued*)

### PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

| Quantity | Navy Type No. | All Symbol Designations Involved | Description |
|---|---|---|---|
| VACUUM TUBES AND SOCKETS (CLASS 38) (*Continued*) | | | |
| 2 | -38758 | X-108, 109 | |
| 1 | ..... | X-201 | 4 Prong Socket |
| R.F. INDUCTORS AND TRANSFORMERS (CLASS 47) | | | |
| 1 | ..... | L-401 | Pri: D.C. Res., 2.5 Ohms ±15% |
| | | | Sec: D.C. Res., 14 Ohms ±15% |
| 1 | ..... | L-402 | Pri: D.C. Res., 225 Ohms ±15% |
| 1 | ..... | L-403 | Sec: D.C. Res., 14 Ohms ±15% |
| 1 | ..... | L-404 | Pri: D.C. Res., .3 Ohms ±15% |
| | | | Sec: D.C. Res., 14 Ohms ±15% |
| 1 | ..... | L-405 | Tap: D.C. Res., 2.4 Ohms ±15% |
| | | | Total: D.C. Res., 9 Ohms ±15% |
| 1 | ..... | L-501 | Pri: D.C. Res., .8 Ohms ±15% |
| | | | Sec: D.C. Res., 4.5 Ohms ±15% |
| 1 | ..... | L-502 | Pri: D.C. Res., 44 Ohms ±15% |
| 1 | ..... | L-503 | Sec: D.C. Res., 4.5 Ohms ±15% |
| 1 | ..... | L-504 | Pri: D.C. Res., .16 Ohms ±15% |
| | | | Sec: D.C. Res., 4.5 Ohms ±15% |
| 1 | ..... | L-505 | Tap: D.C. Res., 5 Ohms ±15% |
| | | | Total: D.C. Res., 10 Ohms ±15% |
| 1 | ..... | L-601 | Pri: D.C. Res., .6 Ohms ±15% |
| | | | Sec: D.C. Res., 2.1 Ohms ±15% |
| 1 | ..... | L-602 | Pri: D.C. Res., 25 Ohms ±15% |
| 1 | ..... | L-603 | Sec: D.C. Res., 2.1 Ohms ±15% |
| 1 | ..... | L-604 | Pri: D.C. Res., .3 Ohms ±15% |
| | | | Sec: D.C. Res., 2.1 Ohms ±15% |
| 1 | ..... | L-605 | Tap: D.C. Res., .6 Ohms ±15% |
| | | | Total: D.C. Res., 1.9 Ohms ±15% |
| 1 | ..... | L-701 | Pri: D.C. Res., .6 Ohms ±15% |
| | | | Sec: D.C. Res., .8 Ohms ±15% |
| 1 | ..... | L-702 | Pri: D.C. Res., 13 Ohms ±15% |
| 1 | ..... | L-703 | Sec: D.C. Res., .8 Ohms ±15% |
| 1 | ..... | L-704 | Pri: D.C. Res., 13 Ohms ±15% |
| 1 | ..... | L-705 | Sec: D.C. Res., .8 Ohms ±15% |
| 1 | ..... | L-706 | Tap: D.C. Res., .17 Ohms ±15% |
| | | | Total: D.C. Res., .8 Ohms ±15% |
| 1 | ..... | L-801 | Pri: D.C. Res., .35 Ohms ±15% |
| | | | Sec: D.C. Res., .2 Ohms ±15% |
| 1 | ..... | L-802 | Pri: D.C. Res., 6 Ohms ±15% |
| 1 | ..... | L-803 | Sec: D.C. Res., .2 Ohms ±15% |
| 1 | ..... | L-804 | Pri: D.C. Res., 6 Ohms ±15% |
| 1 | ..... | L-805 | Sec: D.C. Res., .2 Ohms ±15% |
| 1 | ..... | L-806 | Tap: D.C. Res., .06 Ohms ±15% |
| | | | Total: D.C. Res., .2 Ohms ±15% |
| 1 | ..... | L-901 | Pri: D.C. Res., .27 Ohms ±15% |
| | | | Sec: D.C. Res., .08 Ohms ±15% |
| 1 | ..... | L-902 | Pri: D.C. Res., 3 Ohms ±15% |
| 1 | ..... | L-903 | Sec: D.C. Res., .08 Ohms ±15% |
| 1 | ..... | L-904 | Pri: D.C. Res., .2 Ohms ±15% |
| | | | Sec: D.C. Res., .08 Ohms ±15% |
| 1 | ..... | L-905 | Tap: D.C. Res., .06 Ohms ±15% |
| | | | Total: D.C. Res., .09 Ohms ±15% |
| 1 | ..... | L-1001 | Pri: D.C. Res., Inf. |
| | | | Sec: D.C. Res., .04 Ohms ±15% |
| 1 | ..... | L-1002 | Pri: D.C. Res., .8 Ohms ±15% |
| | | | Tun. Sec: D.C. Res., .06 Ohms ±15% |
| | | | Aperi. Sec: D.C. Res., 6 Ohms ±15% |
| 1 | ..... | L-1003 | Pri: D.C. Res., .8 Ohms ±15% |
| | | | Tun. Sec: D.C. Res., .06 Ohms ±15% |
| | | | Aperi. Sec: D.C. Res., 6 Ohms ±15% |
| 1 | ..... | L-1004 | Tap: D.C. Res., .03 Ohms ±15% |
| | | | Total: D.C. Res., .07 Ohms ±15% |
| 2 | ..... | T-101, 102 | 175 KC. 1.F. Trans. |
| 1 | ..... | T-103 | 175 KC. 1.F. Trans. |
| 1 | ..... | T-104 | 175 KC. Beat Osc. Trans. |
| 1 | ..... | T-401 | R.F. Trans. Assem. Coil Set 1 |
| 1 | ..... | T-402 | R.F. Trans. Assem. Coil Set 1 |
| 1 | ..... | T-403 | R.F. Trans. Assem. Coil Set 1 |
| 1 | ..... | T-404 | R.F. Trans. Assem. Coil Set 1 |
| 1 | ..... | T-501 | R.F. Trans. Assem. Coil Set 2 |
| 1 | ..... | T-502 | R.F. Trans. Assem. Coil Set 2 |
| 1 | ..... | T-503 | R.F. Trans. Assem. Coil Set 2 |
| 1 | ..... | T-504 | R.F. Trans. Assem. Coil Set 2 |
| 1 | ..... | T-601 | R.F. Trans. Assem. Coil Set 3 |
| 1 | ..... | T-602 | R.F. Trans. Assem. Coil Set 3 |
| 1 | ..... | T-603 | R.F. Trans. Assem. Coil Set 3 |
| 1 | ..... | T-604 | R.F. Trans. Assem. Coil Set 3 |
| 1 | ..... | T-701 | R.F. Trans. Assem. Coil Set 4 |
| 1 | ..... | T-702 | R.F. Trans. Assem. Coil Set 4 |
| 1 | ..... | T-703 | R.F. Trans. Assem. Coil Set 4 |
| 1 | ..... | T-704 | R.F. Trans. Assem. Coil Set 4 |
| 1 | ..... | T-801 | R.F. Trans. Assem. Coil Set 5 |
| 1 | ..... | T-802 | R.F. Trans. Assem. Coil Set 5 |

[1] Used only with Type CNA-20090 Power Unit.
[2] Used only with Type CNA-20089 Power Unit.

## 15.3 TABLE II (*Continued*)
## PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

| Quantity | Navy Type No. | All Symbol Designations Involved | Description |
|---|---|---|---|
| R.F. INDUCTORS AND TRANSFORMERS (CLASS 47) (*Continued*) | | | |
| 1 | ..... | T-803 | R.F. Trans. Assem. Coil Set 5 |
| 1 | ..... | T-804 | R.F. Trans. Assem. Coil Set 5 |
| 1 | ..... | T-901 | R.F. Trans. Assem. Coil Set 6 |
| 1 | ..... | T-902 | R.F. Trans. Assem. Coil Set 6 |
| 1 | ..... | T-903 | R.F. Trans. Assem. Coil Set 6 |
| 1 | ..... | T-904 | R.F. Trans. Assem. Coil Set 6 |
| 1 | ..... | T-1001 | R.F. Trans. Assem. Coil Set 7 |
| 1 | ..... | T-1002 | R.F. Trans. Assem. Coil Set 7 |
| 1 | ..... | T-1003 | R.F. Trans. Assem. Coil Set 7 |
| 1 | ..... | T-1004 | R.F. Trans. Assem. Coil Set 7 |
| CAPACITORS (CLASS 48) | | | |
| 1 | °-48286A | C-119 | |
| 1 | -48690-10 | C-140 | |
| 1 | °[1]-48695-10 | C-146 | |
| 1 | -48848-10 | C-110 | |
| 1 | -48854-3 | C-406 | |
| 1 | -48983-3 | C-1007 | |
| 3 | -48983-10 | C-102, 124, 135 | |
| 1 | -481016-3 | C-506 | |
| 1 | -481037-10 | C-103 | |
| 1 | -481042-10 | C-109 | |
| 1 | -481043-10 | C-137 | |
| 1 | -481044 | C-134 | |
| 1 | -481045 | C-147 | |
| 2 | -481046-10 | C-201, 202 | |
| 5 | -481072 | C-107, 117, 123, 130, 142 | |
| 9 | -481073 | C-104, 108, 113, 118, 125, 127, 129, 133, 141 | |
| 1 | -481074 | C-138 | |
| 6 | -481075 | C-105, 106, 111, 112, 114, 139 | |
| 3 | -481076 | C-120, 136, 143 | |
| 1 | -481077-10 | C-1003 | |
| 4 | -481080 | C-203, 204, 205, 206 | |
| 2 | -481084-3 | C-606, 1002 | |
| 1 | -481085-3 | C-705 | |
| 1 | -481086-3 | C-805 | |
| 1 | -481087-3 | C-905 | |
| 1 | ..... | C-101 | Var. Air: 4 gang, 12 to 225 mmf. per section ±10% |
| 8 | ..... | C-115, 116, 121, 122, 131, 132, 144, 145 | Var. Air: 6 to 85 mmf. ±10% |
| 1 | ..... | C-126 | Var. Air: 8 to 120 mmf. ±10% |
| 1 | ..... | C-128 | Bakelite: 2 mmf. 400 V DC W |
| 24 | ..... | C-401, 402, 403, 404, 601, 602, 603, 604, 701, 702, 703, 704, 801, 802, 803, 804, 901, 902, 903, 904, 1001, 1004, 1005, 1006 | Var. Air: 5 to 28 mmf. ±10% |
| 1 | ..... | C-405 | Var. Air: 7 to 60 mmf. ±10% |
| 5 | ..... | C-501, 502, 503, 504, 605 | Var. Air: 6 to 38 mmf. ±10% |
| 1 | ..... | C-505 | Var. Air: 8 to 68 mmf. ±10% |
| JACKS, PLUGS, RECEPTACLES AND LOUD SPEAKERS (CLASS 49) | | | |
| 1 | ..... | J-101 | Multi-Circuit Jack |
| 1 | ..... | J-201 | Motor Plug Cap |
| 1 | ..... | J-202 | 4 Prong Socket |
| 1 | ..... | J-203 | Fuse Clip Mounting |
| 1 | ..... | P-101 | 4 Prong with Rubber Cap |
| 1 | ..... | P-201 | 2 Prong, 660 W., 250 V. |
| 1 | ..... | P-202 | Cord Connector Body |
| 1 | ..... | LS-301 | 8 inch Size, PM Field |
| RESISTORS (CLASS 63) | | | |
| 1 | -63288 | R-133 | 50,000 Ohms |
| 1 | -63360 | R-129 | 250 Ohms |
| 4 | -63360 | R-102, 104, 114, 138 | 300 Ohms |
| 1 | -63360 | R-125 | 1,500 Ohms |
| 2 | -63360 | R-111, 118 | 2,000 Ohms |
| 2 | -63360 | R-106, 110 | 5,000 Ohms |
| 1 | -63360 | R-135 | 10,000 Ohms |
| 3 | -63360 | R-105, 132, 134 | 20,000 Ohms |
| 1 | -63360 | R-108 | 25,000 Ohms |
| 1 | -63360 | R-119 | 50,000 Ohms |
| 5 | -63360 | R-107, 109, 120, 121, 127 | 100,000 Ohms |
| 1 | -63360 | R-122 | 250,000 Ohms |
| 6 | -63360 | R-101, 103, 112, 123, 126, 128 | 500,000 Ohms |
| 2 | -63360 | R-113, 124 | 1 Megohm |
| 1 | -63474 | R-137 | 250 Ohms |
| 2 | -63474 | R-130, 131 | 1,000 Ohms |
| 1 | -63474 | R-117 | 15,000 Ohms |
| 1 | -63474 | R-116 | 30,000 Ohms |
| 1 | -63751 | R-139 | |
| 1 | -63756 | R-115 | |
| 1 | -63757 | R-136 | |

[1] Assignment for Mfr. Desig. 1461.
° Assignment for Replacement Use Only.

## 15.4 TABLE III

## SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

| Navy Type | Name | Symbol Group |
|---|---|---|
| CNA-46080 | RADIO RECEIVER | 101-199 |
| CNA-20089 | POWER UNIT | 201-299 |
| CNA-20090 | POWER UNIT | 201-299 |
| CNA-49105 | LOUD SPEAKER | 301-399 |
| CNA-49106 | LOUD SPEAKER | 301-399 |
| CNA-47156 | COIL SET 1 | 401-499 |
| CNA-47157 | COIL SET 2 | 501-599 |
| CNA-47158 | COIL SET 3 | 601-699 |
| CNA-47159 | COIL SET 4 | 701-799 |
| CNA-47160 | COIL SET 5 | 801-899 |
| CNA-47161 | COIL SET 6 | 901-999 |
| CNA-47162 | COIL SET 7 | 1001-1099 |

| Quantity | Navy Type Desig. | All Symbol Designations Involved | Description | National Co. Dwg. And Part Number |
|---|---|---|---|---|
| | | FUSES (CLASS 28) | | |
| 1 | ..... | F-201, 202 | 1 Amp. Glass Enclosed, *3AG | |
| | | A.F. TRANSFORMERS AND INDUCTORS (CLASS 30) | | |
| 1 | CNA-30497 | T-105 | 600/600 Ohm ±10% Audio Trans. Primary: 1340 Turns No. 29, D.C. Res. 40 Ohms ±10%. Secondary: 1340 Turns (total) No. 29 C.T. D.C. Res. C.T. to Inside, 25 Ohms ±10%. C.T. to Outside 30 Ohms ±10%, *F-600A | C-285 |
| 1 | CNA-30498 | [1]T-201 | 110/120 Volt, 50/60 Cycle Power Trans. Primary: (Terminals 1 and 2) 600 Turns No. 24. D.C. Res. 8 Ohms ±10%. ½ H.V. Sec.: (Terminals 3 and 4) 1700 Turns No. 35. D.C. Res. 380 Ohms ±10%. ½ H.V. Sec.: (Terminals 4 and 5) 1700 Turns No. 35 D.C. Res. 420 Ohms ±10%. V-201 Fil. Sec.: (Terminals 6 and 7) 28 Turns No. 17. D.C. Res. .12 Ohms ±10%. Heater Sec.: (Terminals 8 and 9) 36 Turns No. 16. D.C. Res. .13 Ohms ±10%. Shield: (Terminal G). *12069C. | C-301 |
| 1 | CNA-30499 | [2]T-201 | 110/120 Volt, 25 Cycle. Power Trans. Primary: (Terminals 1 and 2) 900 Turns No. 24. D.C. Res. 13 Ohms ±10%. ½ H.V. Sec.: (Termi- | C-301 |

* Manufacturer's Type.
[1] Supplied only with Equipments utilizing the type CNA-20090 Power Unit.
[2] Supplied only with Equipments utilizing the type CNA-20089 Power Unit.

## 15.4 TABLE III (*Continued*)

### SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

| Quantity | Navy Type Desig. | All Symbol Designations Involved | Description | National Co. Dwg. And Part Number |
|---|---|---|---|---|
| | | | **A.F. TRANSFORMERS AND INDUCTORS (CLASS 30) (*Continued*)** | |
| | | | nals 3 and 4) 2550 Turns No. 34. D.C. Res. 450 Ohms ±10%. ½ H.V. Sec.: (Terminals 4 and 5) 2550 Turns No. 34. D.C. Res. 500 Ohms ±10%. V-201 Fil. Sec.: (Terminals 6 and 7) 45 Turns No. 16. D.C. Res. .15 Ohms ±10%. Heater Sec.: (Terminals 8 and 9) 59 Turns No. 16 D.C. Res. .22 Ohms ±10%. Shield: (Terminal G). *12360C. | |
| 1 | CNA-30500 | L-201 | Inductor: 5000 Turns No. 31, D.C. Res. 300 Ohms ±10%, 17 Henry ±20%, .08 Amp. *J4373C. | C-327 |
| 1 | CNA-30501 | T-301 | 5000/2.8 Ohm Audio Coupling Trans. Primary: (Terminals 1 and 2) 2300 Turns No. 36. D.C. Res. 275 Ohms ±10%. Secondary: (Terminals 3 and 4) 52 Turns No. 19. D.C. Res. .16 Ohms ±10%. *5537C. | C-295 |
| | | | **VACUUM TUBES (CLASS 38)** | |
| 1 | CRC-38593 | V-201 | Full Wave Rectifier. *5Z3 | |
| 3 | CRC-38636 | V-103, 104, 108 | R.F. Pentode. *6C6 | |
| 4 | CRC-38646 | V-101, 102, 105, 106 | R.F. Pentode. *6D6 | |
| 1 | CRC-38768F | V-107 | Dual Triode. *6F8G | |
| 1 | ..... | V-109 | Beam Audio Output. *6V6G° | |
| | | | **R.F. TRANSFORMERS (CLASS 47)** | |
| 1 | ..... | T-101, 102 | 175 KC. I.F. Trans. *IFC-88 | |
| 1 | ..... | T-103 | 175 KC. C.W. Osc. Trans. *IFCO-2 | |
| 1 | ..... | T-104 | 175 KC. I.F. Trans. *IFC-89 | |
| | | | **CAPACITORS (CLASS 48)** | |
| 1 | #CAW-48286A | C-119 | Paper: 1 mfd. +20%-10%, 400 V DC W. *461 | |
| 1 | CAW-48690-10 | C-140 | Mica: .00025 mfd. ±10%, 500 V DC W. *1468 | |
| 1 | CAW-48848-10 | C-110 | Mica: .01 mfd. ±10%, 300 V DC W *1467 | |
| 1 | CAW-48854-3 | C-406 | Mica: .0003 mfd. ±3%, 500 V DC W *1467 | |

* Manufacturer's Type.
\# Assignment for REPLACEMENT USE ONLY.
° 6V6GT may be substituted.

## 15.4 TABLE III (*Continued*)

## SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

| Quantity | Navy Type Desig. | All Symbol Designations Involved | Description | National Co. Dwg. And Part Number |
|---|---|---|---|---|
| | | CAPACITORS (CLASS 48) (*Continued*) | | |
| 1 | CAW-48983-3 | C-1007 | Mica: .001 mfd. ±3%, 500 V DC W *1467 | |
| 2 | CAW-48983-10 | C-102, 124, 135 | Mica: .001 mfd. ±10%, 500 V DC W *1467 | |
| 1 | CAW-481016-3 | C-506 | Mica: .0007 mfd. ±3%, 500 V DC W *1467 | |
| 1 | CAW-481037-10 | C-103 | Mica: .005 mfd. ±10%, 300 V DC W *1467 | |
| 1 | CAW-481042-10 | C-109 | Mica: .0001 mfd. ±10%, 500 V DC W *1465 | |
| 1 | CAW-481043-10 | C-137 | Mica: .0005 mfd. ±10%, 500 V DC W *1467 | |
| 1 | CD -481044 | C-134 | Electrolytic: 10 mfd., 50 V DC W *FA10025 | |
| 1 | CD -481045 | C-147 | Electrolytic: 25 mfd., 50 V DC W *FA10062 | |
| 3 | CAW-481072 | C-107, 117, 123, 130, 142 | Paper: .01 mfd. +20%-10%, 400 V DC W *489 | |
| 5 | CAW-481073 | C-104, 108, 113, 118, 125, 127, 129, 133, 141 | Paper: .1 mfd. +20%-10%, 400 V DC W *489 | |
| 1 | CAW-481074 | C-138 | Paper: .25 mfd. +20%-10%, 400 V DC W *489 | |
| 3 | CAW-481075 | C-105, 106, 111, 112, 114, 139 | Paper: .1 mfd. +20%-10%, 600 V DC W *689 | |
| 2 | CAW-481076 | C-120, 136, 143 | Paper: .25 mfd. +20%-10%, 600 V DC W *689 | |
| 1 | CAW-481077-10 | C-1003 | Mica: .00004 mfd. ±10%, 500 V DC W *1468 | |
| 2 | CD -481080 | C-203, 204, 205, 206 | Paper: 4 mfd. 600 V DC W *TL-AD 6040 | |
| 1 | CAW-481084-3 | C-606, 1002 | Mica: .0012 mfd. ±3%, 500 V DC W *1467 | |
| 1 | CAW-481085-3 | C-705 | Mica: .0026 mfd. ±3%, 500 V DC W *1467 | |
| 1 | CAW-481086-3 | C-805 | Mica: .0051 mfd. ±3%, 300 V DC W *1467 | |
| 1 | CAW-481087-3 | C-905 | Mica: .0088 mfd. ±3%, 300 V DC W *1467 | |
| 1 | ..... | C-128 | Bakelite: 2 mmf. 400 V DC W *B22 | |
| | | RESISTORS (CLASS 63) | | |
| 1 | CBN-63288 | R-133 | 50,000 Ohm, ±10%, 1 Watt *314 | |
| 1 | CBN-63360 | R-129 | 250 Ohm, ±10%, ½ Watt *310 | |
| 2 | CBN-63360 | R-102, 104, 114, 138 | 300 Ohm, ±10%, ½ Watt *310 | |
| 1 | CBN-63360 | R-125 | 1,500 Ohm, ±10%, ½ Watt *310 | |
| 1 | CBN-63360 | R-111, 118 | 2,000 Ohm, ±10%, ½ Watt *310 | |
| 1 | CBN-63360 | R-106, 110 | 5,000 Ohm, ±10%, ½ Watt *310 | |

* Manufacturer's Type.

## 15.4 TABLE III (*Continued*)

### SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS FOR MODEL RAS RADIO RECEIVING EQUIPMENT

| Quantity | Navy Type Desig. | All Symbol Designations Involved | Description | National Co. Dwg. And Part Number |
|---|---|---|---|---|
| | | RESISTORS (CLASS 63) (*Continued*) | | |
| 1 | CBN-63360 | R-135 | 10,000 Ohm, ±10%, ½ Watt *310 | |
| 2 | CBN-63360 | R-105, 132, 134 | 20,000 Ohm, ±10%, ½ Watt *310 | |
| 1 | CBN-63360 | R-108 | 25,000 Ohm, ±10%, ½ Watt *310 | |
| 3 | CBN-63360 | R-107, 109, 120, 121, 127 | 100,000 Ohm, ±10%, ½ Watt *310 | |
| 1 | CBN-63360 | R-122 | 250,000 Ohm, ±10%, ½ Watt *310 | |
| 3 | CBN-63360 | R-101, 103, 112, 123, 126, 128 | 500,000 Ohm, ±10%, ½ Watt *310 | |
| 1 | CBN-63474 | R-137 | 250 Ohm, ±10%, 2 Watt *316 | |
| 1 | CBN-63474 | R-130, 131 | 1,000 Ohm, ±10%, 2 Watt *316 | |
| 1 | CBN-63474 | R-117 | 15,000 Ohm, ±10%, 2 Watt *316 | |
| 1 | CBN-63474 | R-116 | 30,000 Ohm, ±10%, 2 Watt *316 | |
| 1 | CYM-63751 | R-139 | 64 Ohm, C.T., 3 Watt *864C | |
| 1 | CMC-63756 | R-115 | 10,000 Ohm, 1.5 Watt, W.W. Var. *P58-10,000U | |
| 1 | CBN-63757 | R-136 | 500,000 Ohm, 1 Watt, Comp. Var. *72-105 | |

Prefix letters on items indicate the exact types *originally* furnished as spare parts.
Replacements of these spares need not carry same prefix letters.
* Manufacturer's Type.

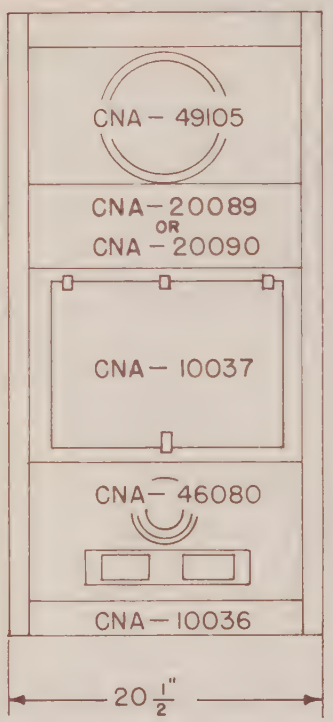
### RMA COLOR CODE FOR RESISTORS

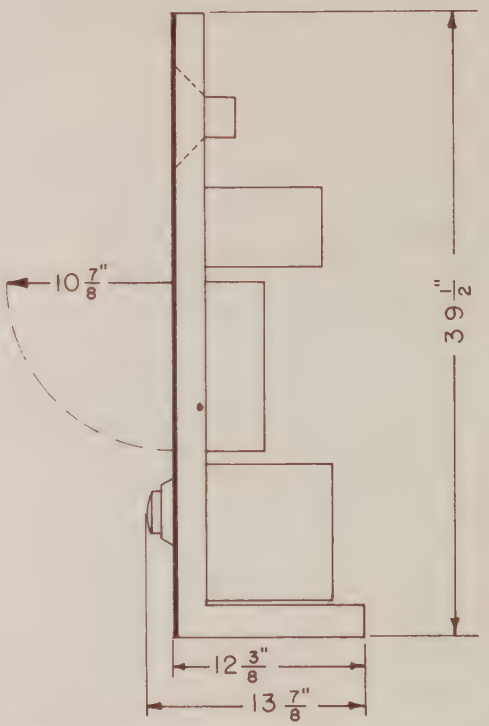
| *Color* | *Body* | *End* | *Dot* |
|---|---|---|---|
| Black | — | 0 | .0 |
| Brown | 1 | 1 | 0 |
| Red | 2 | 2 | 00 |
| Orange | 3 | 3 | 000 |
| Yellow | 4 | 4 | 0000 |
| Green | 5 | 5 | 00000 |
| Blue | 6 | 6 | 000000 |
| Purple | 7 | 7 | 0000000 |
| Gray | 8 | 8 | 00000000 |
| White | 9 | 9 | — |

Body color denotes first numeral in resistance value.
End color denotes second numeral.
Dot color denotes number of ciphers following first two numerals.
Gold color bronze end dip indicates 5% tolerance.
Silver color bronze end dip indicates 10% tolerance.
Other resistors 20% tolerance.

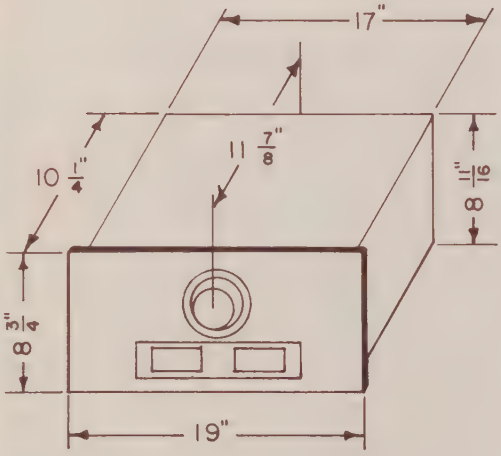
## 15.5 LIST OF MANUFACTURERS

| CODE NO. | MFR. PREFIX | NAME | ADDRESS |
|---|---|---|---|
| 1 | CAW | Aerovox Corporation | New Bedford, Mass. |
| 2 | CBN | Central Radio Labs. | Milwaukee, Wisconsin |
| 3 | CD | Cornell Dubilier Elec. Corp. | So. Plainfield, N. J. |
| 4 | CG | General Electric (Mazda) | Cleveland, Ohio |
| 5 | CHH | Arrow-Hart & Hegeman | Hartford, Conn. |
| 6 | CLF | Littelfuse Laboratories | Chicago, Illinois |
| 7 | CMC | Clarostat Mfg. Co., Inc. | Brooklyn, N. Y. |
| 8 | CNA | National Company, Inc. | Malden, Mass. |
| 9 | CRC | RCA Manufacturing Company<br>RCA Radiotron Division | Harrison, N. J. |
| 10 | CYM | Yaxley Division of<br>P. R. Mallory & Co., Inc. | Indianapolis, Ind. |
| 11 | | The Rola Co., Inc. | Cleveland, Ohio |
| 12 | | Cinch Mfg. Co. | Chicago, Illinois |
| 13 | | Cornish Wire Company | New York, N. Y. |
| 14 | | P. & F. Corbin | New Britain, Conn. |



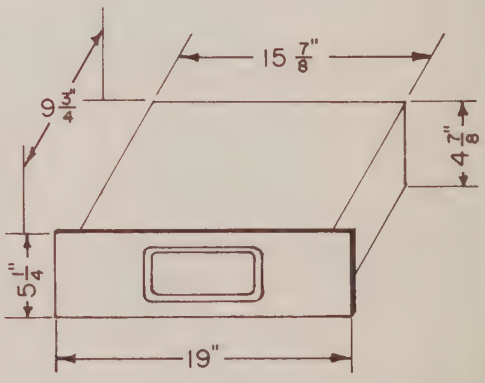




MODEL RAS EQUIPMENT DWG. NO. 16.01



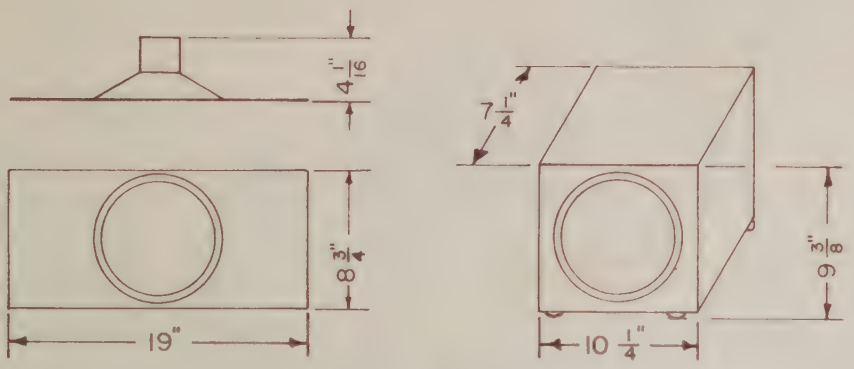

RADIO RECEIVER

DWG. NO. 16.02



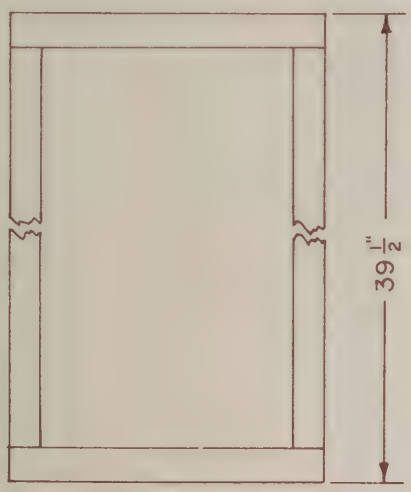

POWER UNITS

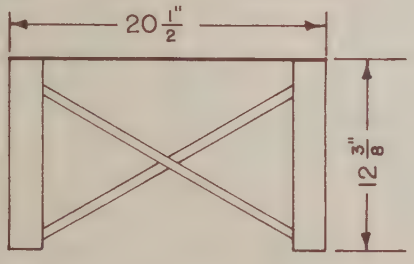
DWG. NO. 16.03




LOUD SPEAKERS

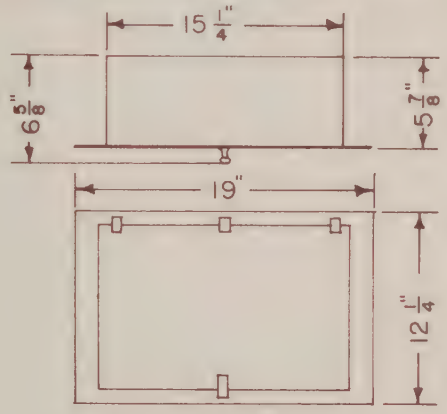
DWG. NO. 16.04



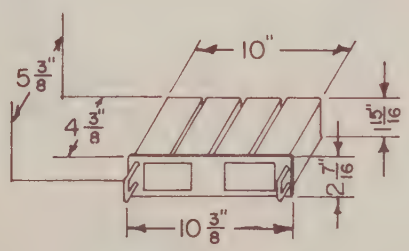

MOUNTING RACK

DWG. NO. 16.06



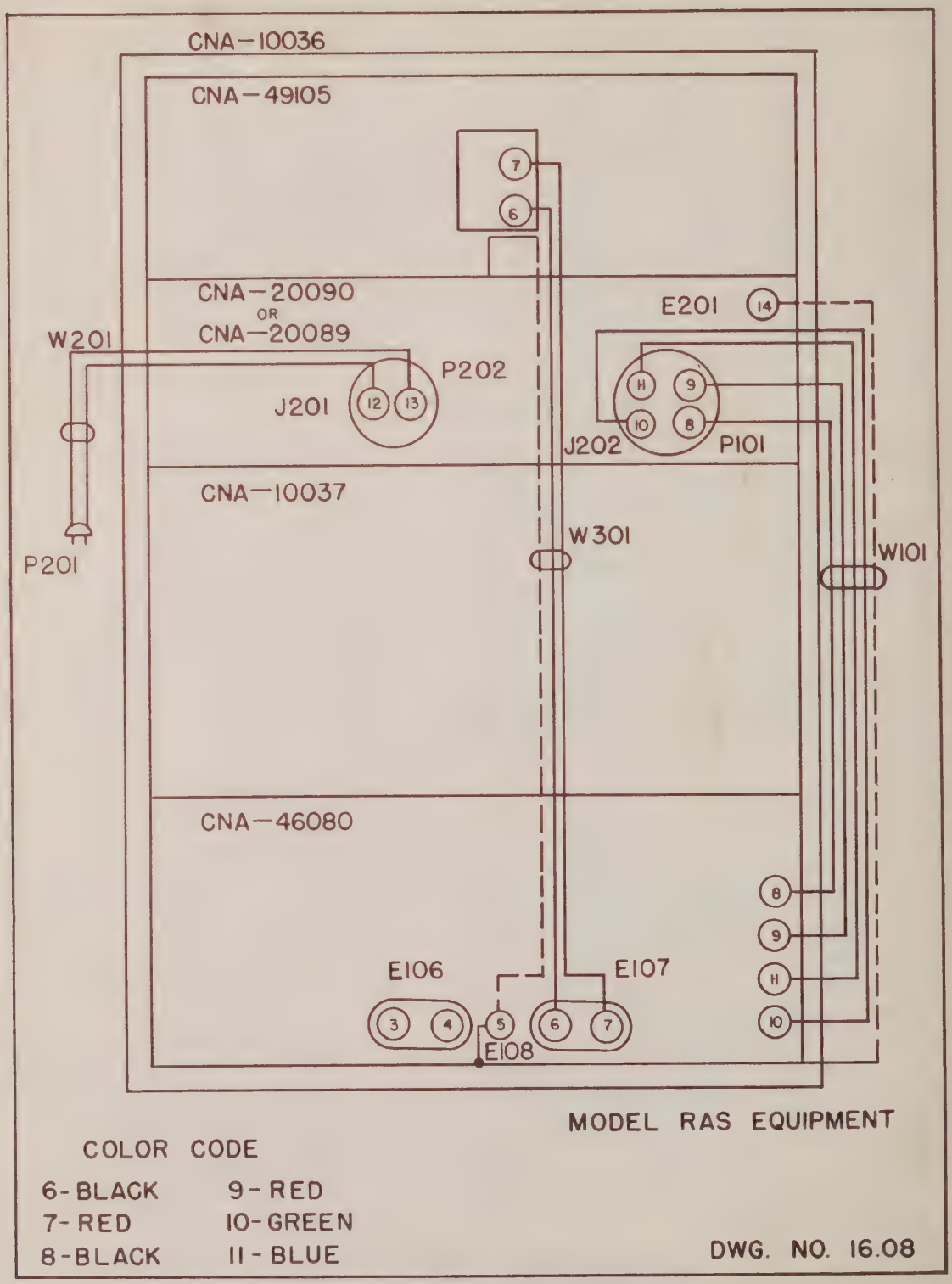

COIL SYSTEM CONTAINER

DWG. NO. 16.05

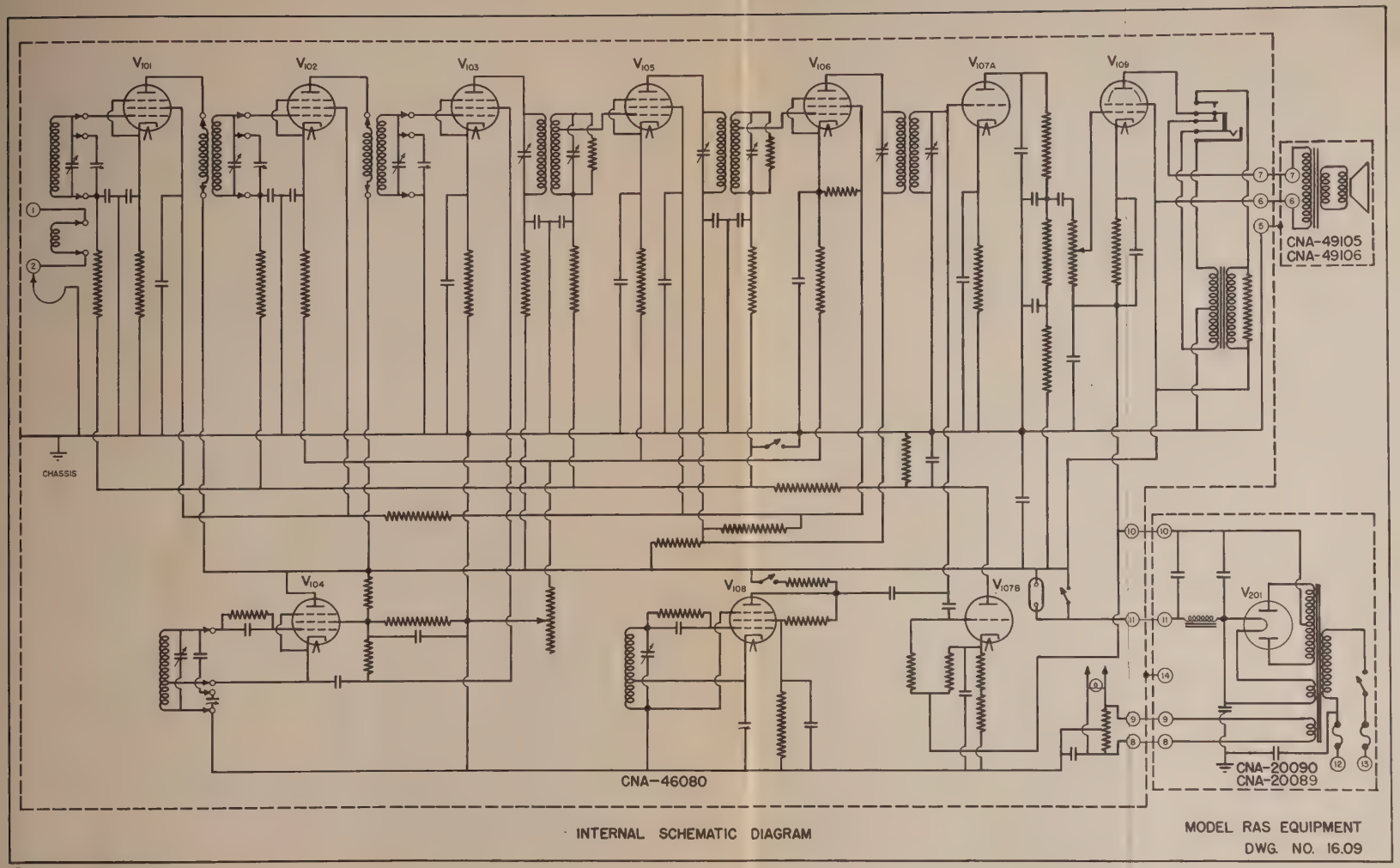



TYPICAL COIL SET

DWG. NO. 16.07



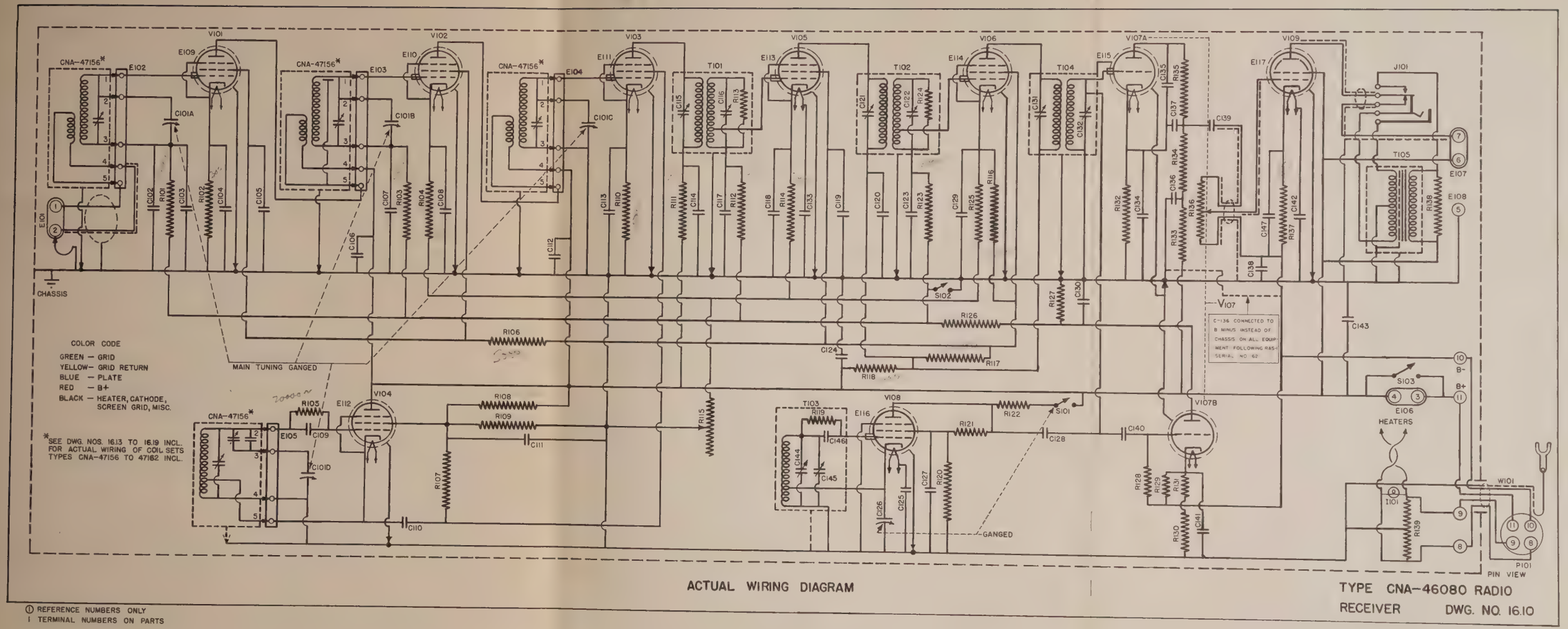

EXTERNAL WIRING CONNECTIONS




INTERNAL SCHEMATIC DIAGRAM

MODEL RAS EQUIPMENT
DWG. NO. 16.09

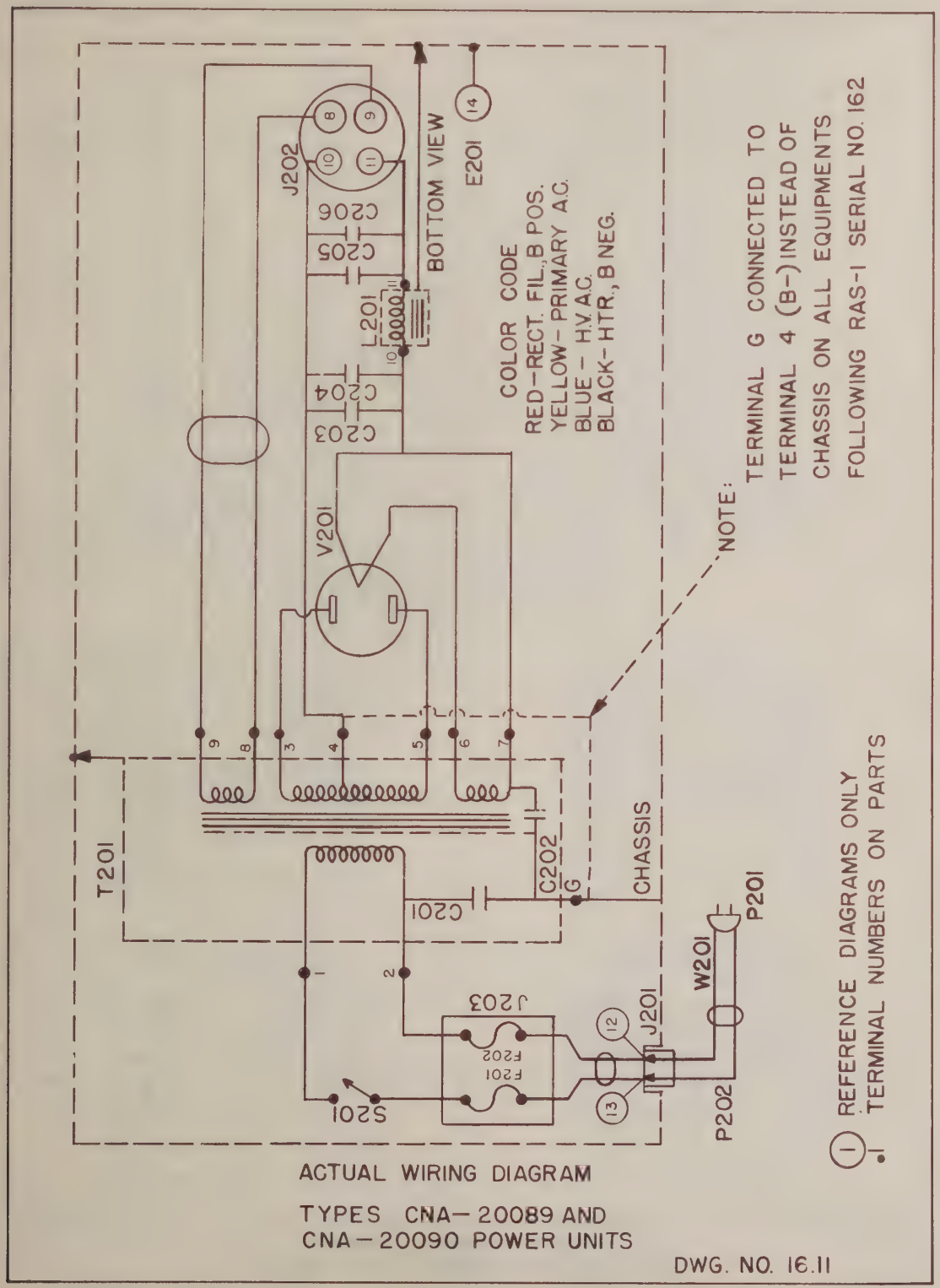
① REFERENCE NUMBERS ONLY

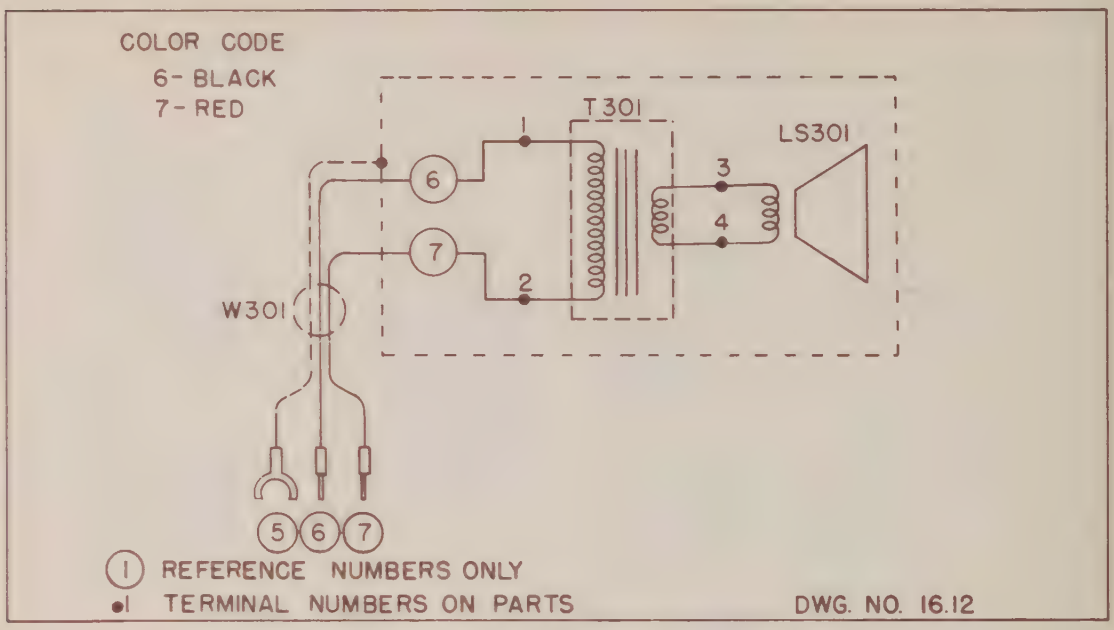



ACTUAL WIRING DIAGRAM

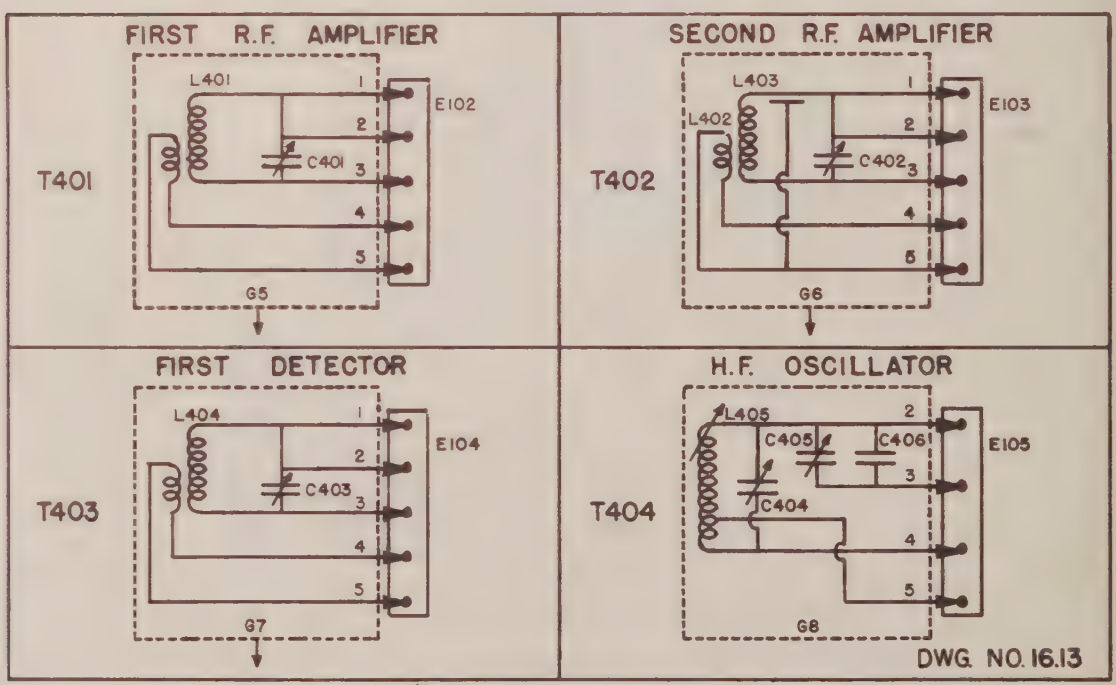
TYPE CNA-46080 RADIO RECEIVER DWG. NO. 16.10

① REFERENCE NUMBERS ONLY
I TERMINAL NUMBERS ON PARTS

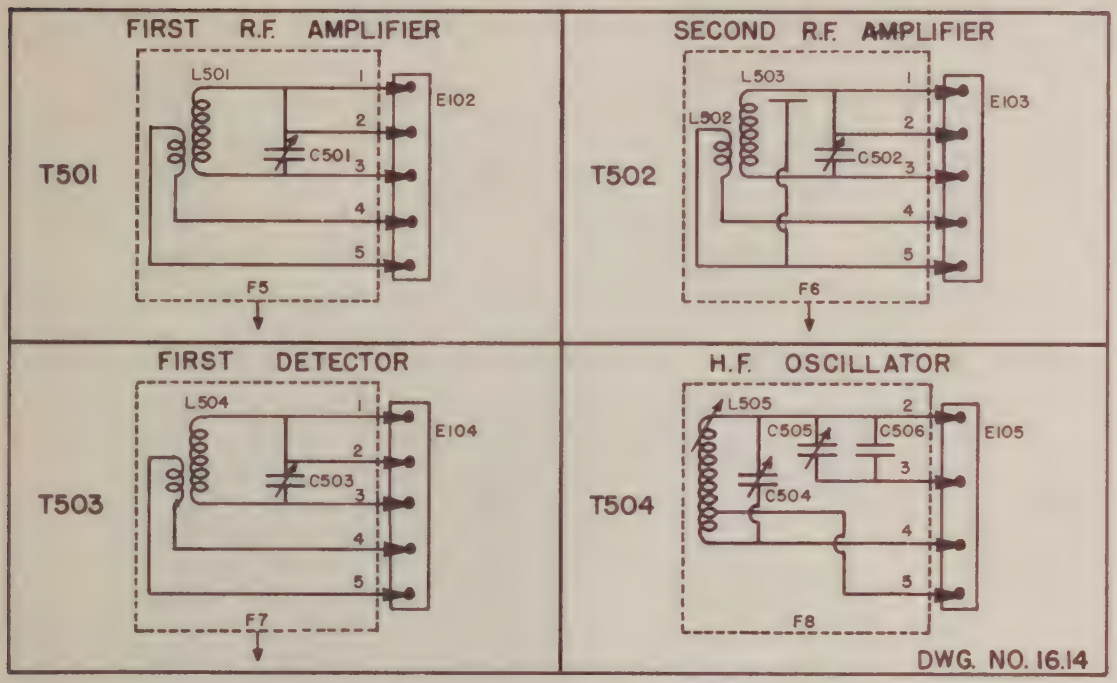

J202
BOTTOM VIEW
E201
C206
C205
L201
C204
C203
V201
COLOR CODE
RED-RECT. FIL., B POS.
YELLOW-PRIMARY A.C.
BLUE - H.V.A.C.
BLACK-HTR., B NEG.
NOTE:
TERMINAL G CONNECTED TO TERMINAL 4 (B-) INSTEAD OF CHASSIS ON ALL EQUIPMENTS FOLLOWING RAS-1 SERIAL NO. 162
T201
C202
CHASSIS
C201
P201
W201
J203
F202
F201
J201
S201
P202
REFERENCE DIAGRAMS ONLY
TERMINAL NUMBERS ON PARTS
ACTUAL WIRING DIAGRAM
TYPES CNA-20089 AND
CNA-20090 POWER UNITS
DWG. NO. 16.11



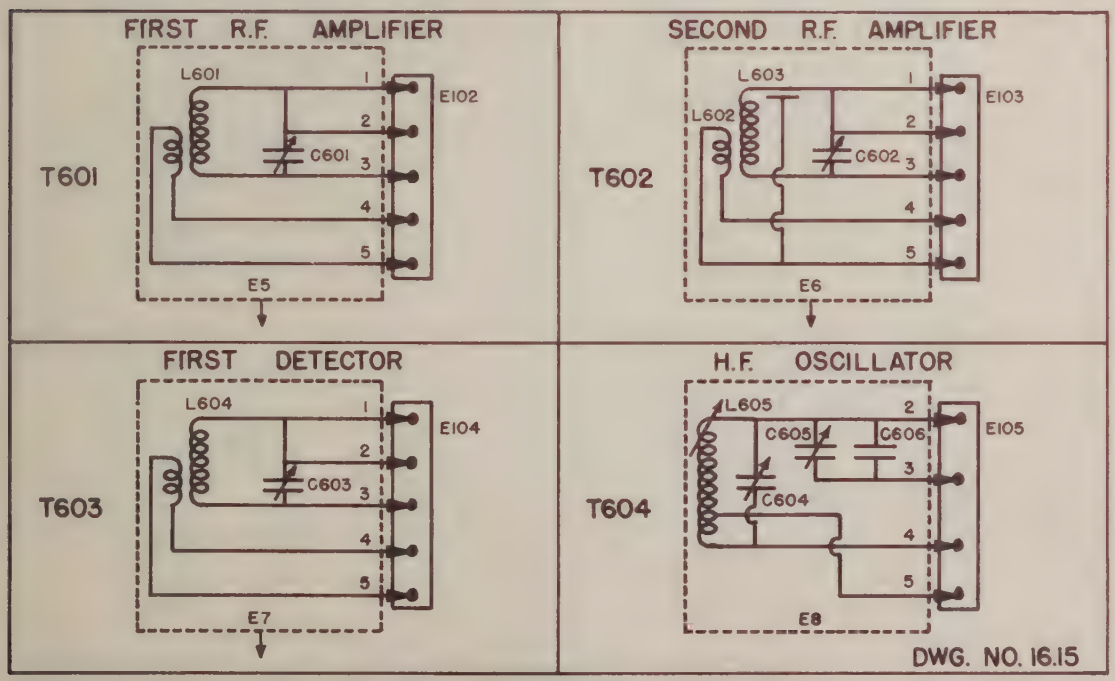

ACTUAL WIRING DIAGRAM
TYPES CNA-49105 AND CNA-49106
LOUD SPEAKER UNITS



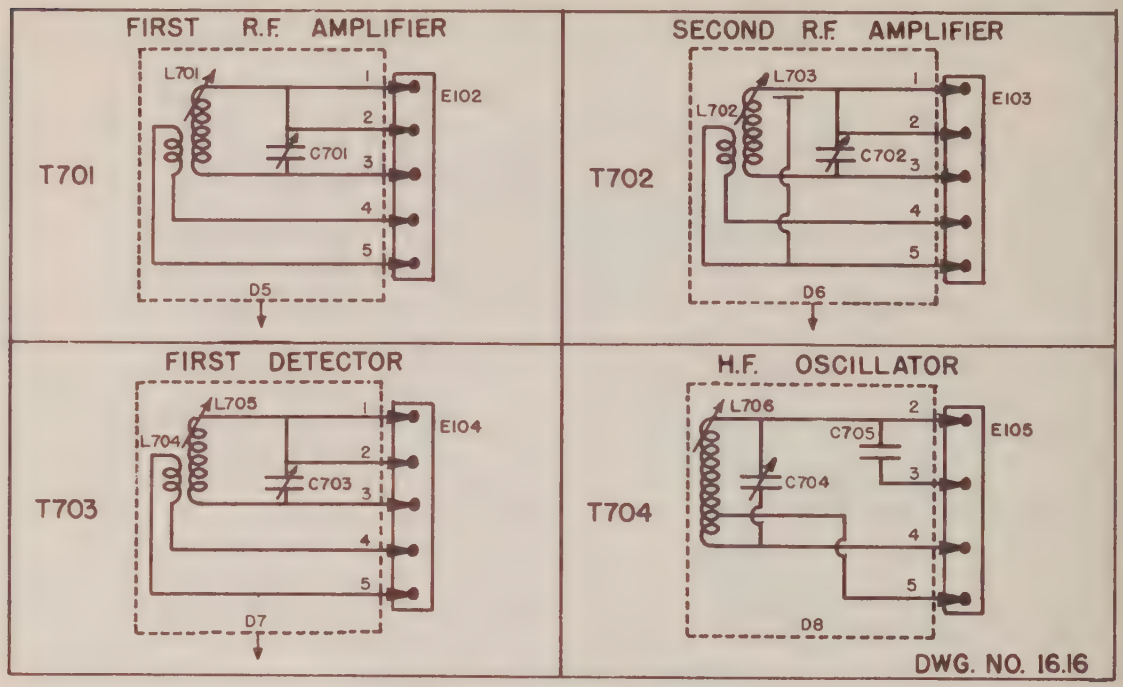

ACTUAL WIRING DIAGRAM
TYPE CNA-47156 COIL SET 1



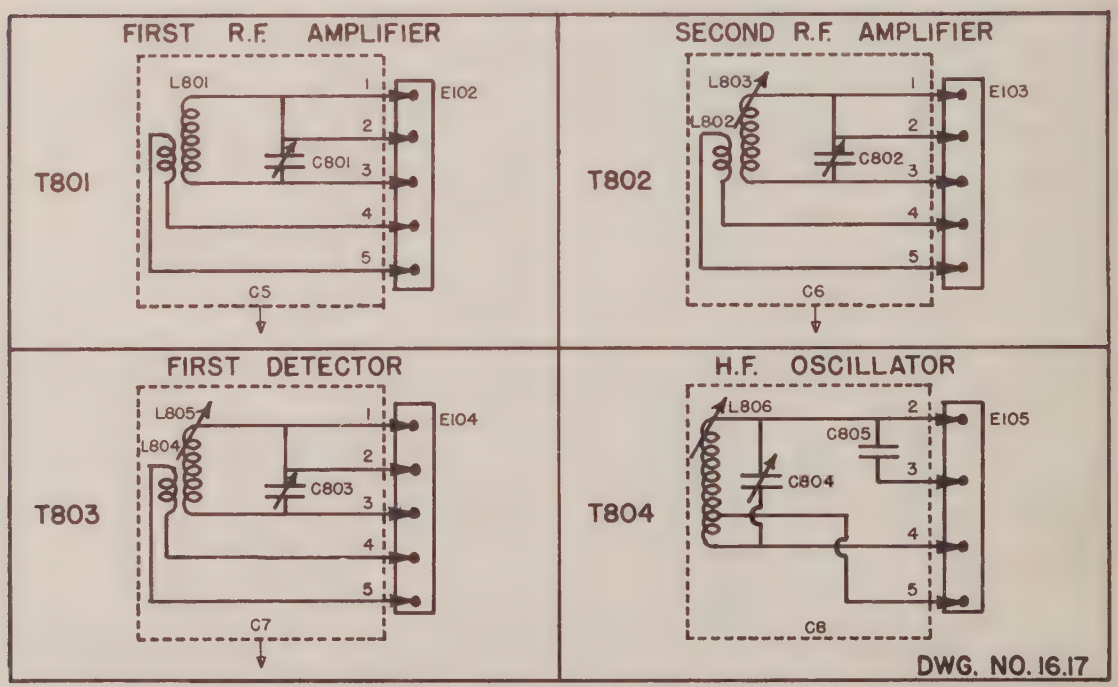

ACTUAL WIRING DIAGRAM
TYPE CNA-47157 COIL SET 2



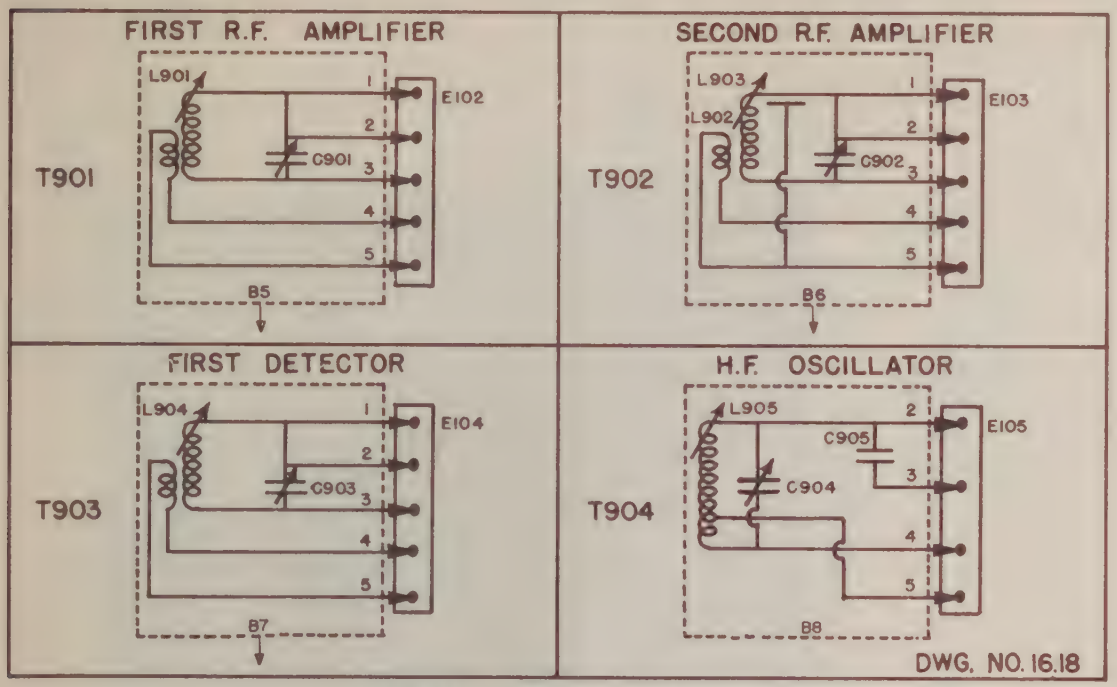

ACTUAL WIRING DIAGRAM
TYPE CNA-47158 COIL SET 3



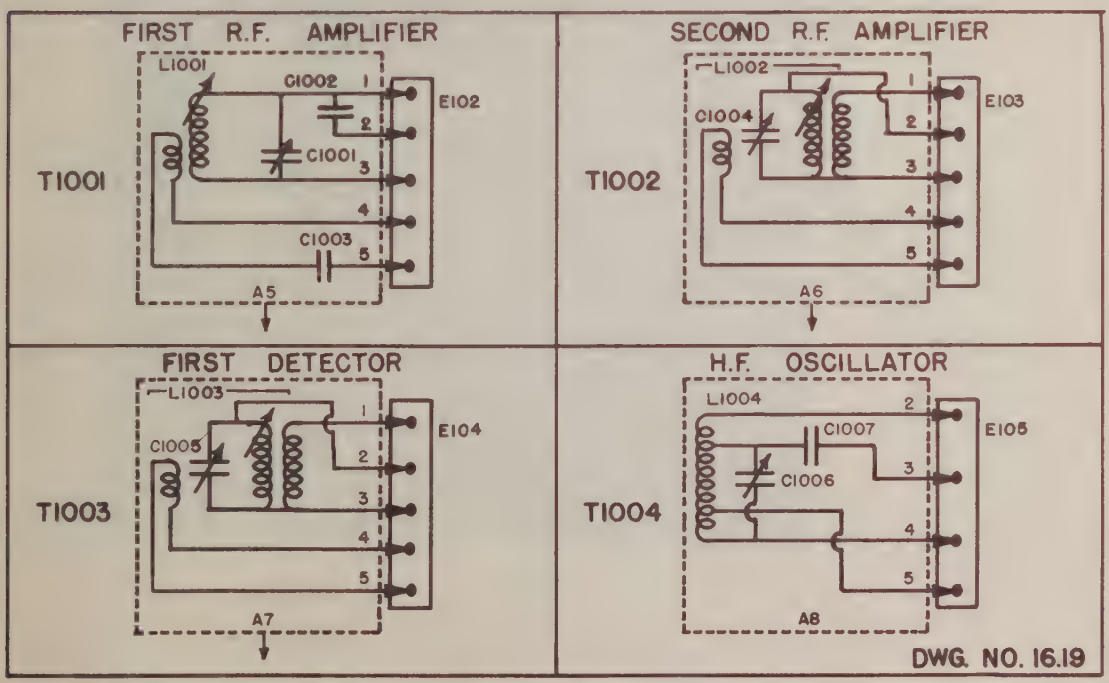

ACTUAL WIRING DIAGRAM
TYPE CNA—47159 COIL SET 4




ACTUAL WIRING DIAGRAM
TYPE CNA—47160 COIL SET 5




ACTUAL WIRING DIAGRAM
TYPE CNA—47161 COIL SET 6




ACTUAL WIRING DIAGRAM
TYPE CNA—47162 COIL SET 7

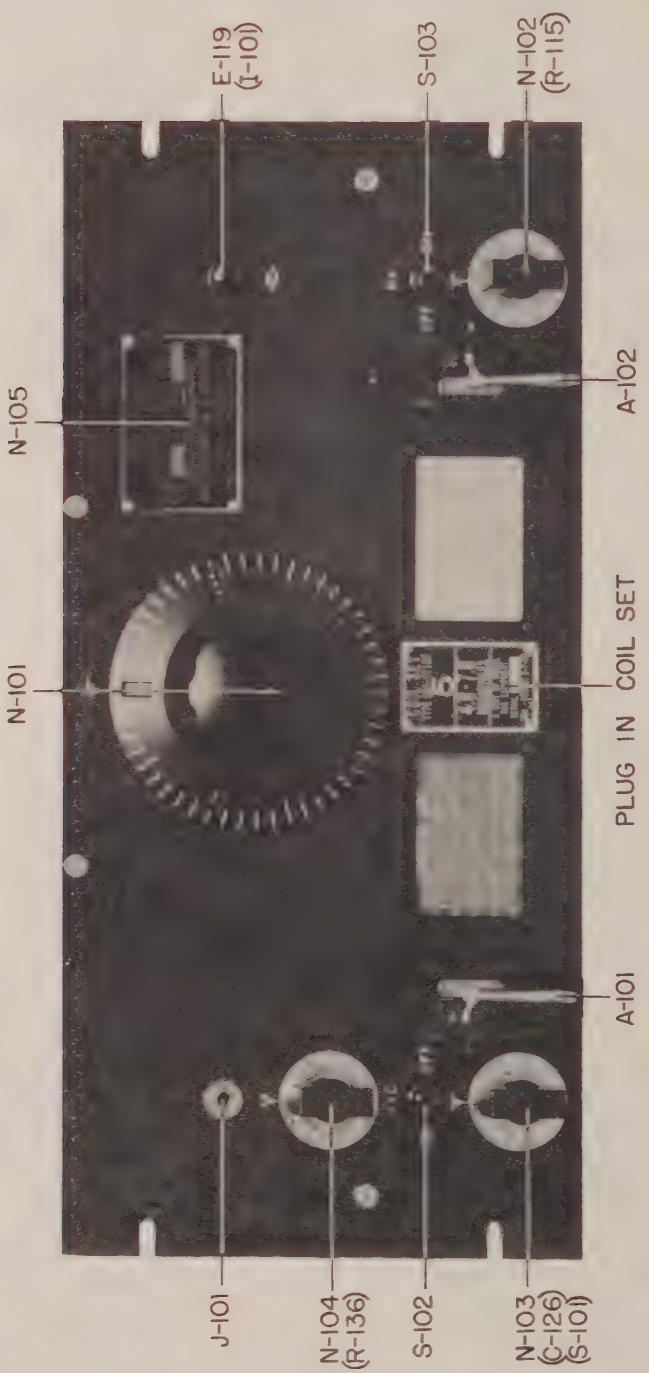



PHOTO NO. 17.01 FRONT VIEW OF RADIO RECEIVER

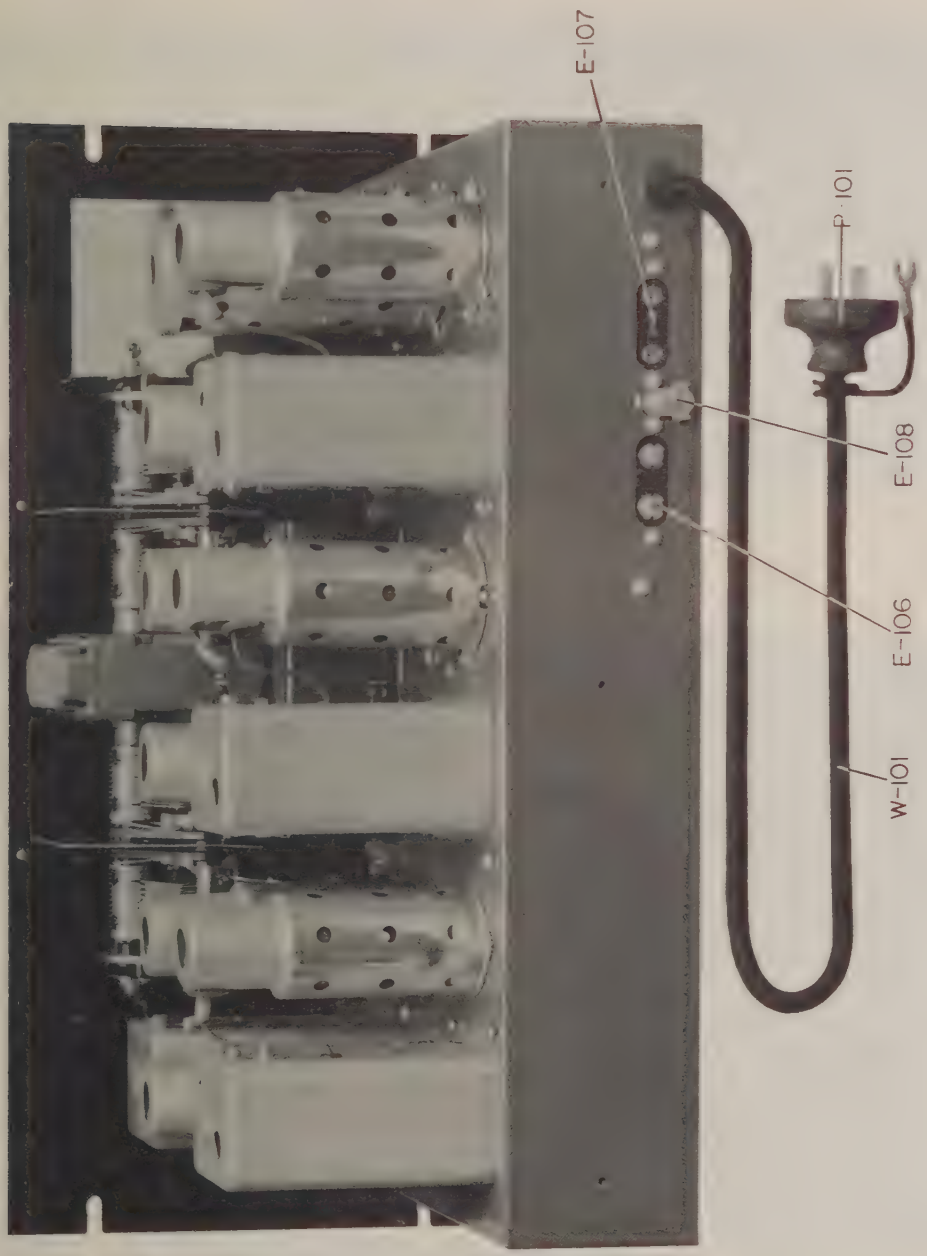



PHOTO NO. 17.02 REAR VIEW OF RADIO RECEIVER

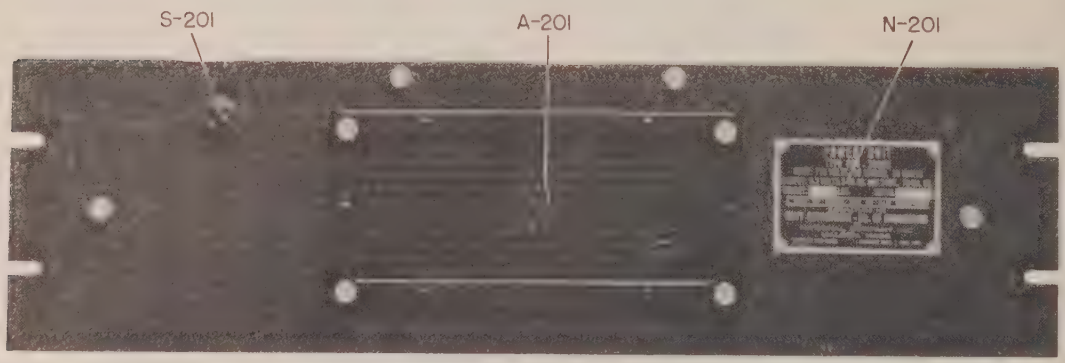



PHOTO NO. 17.03 FRONT VIEW OF POWER UNIT

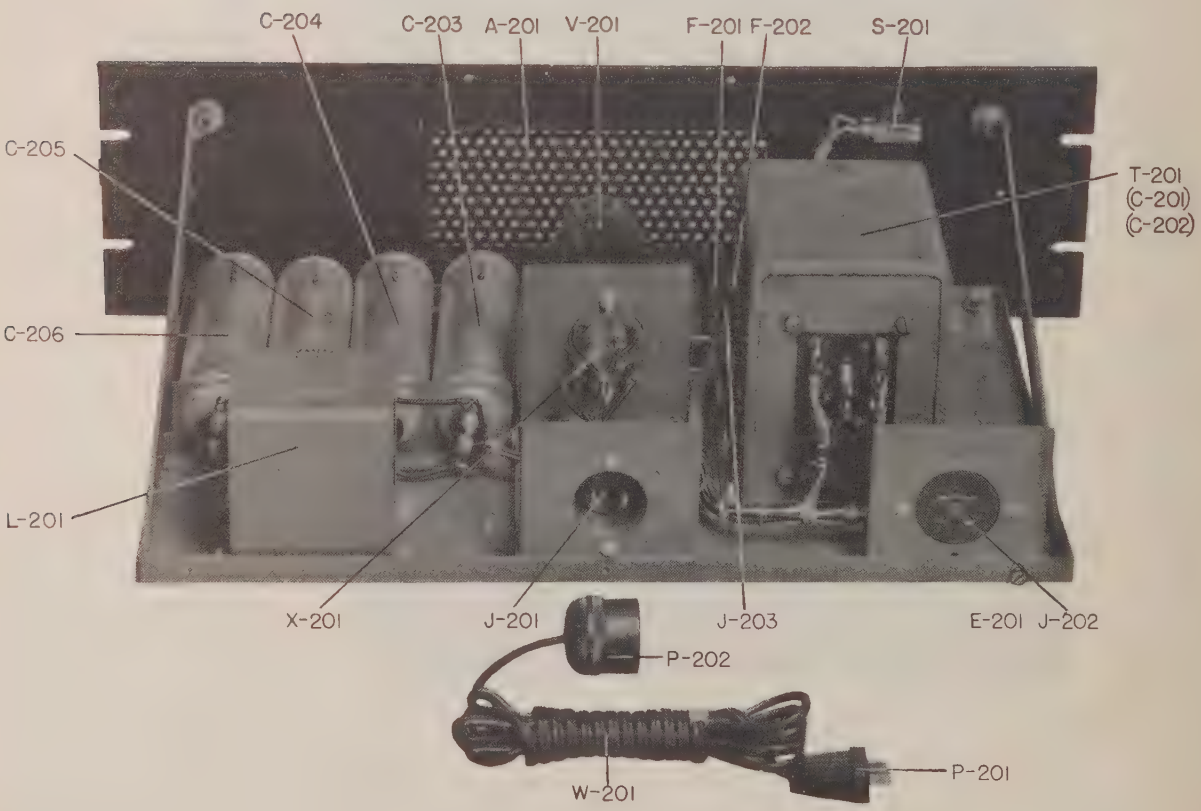



PHOTO NO. 17.04 INTERNAL VIEW OF POWER UNIT

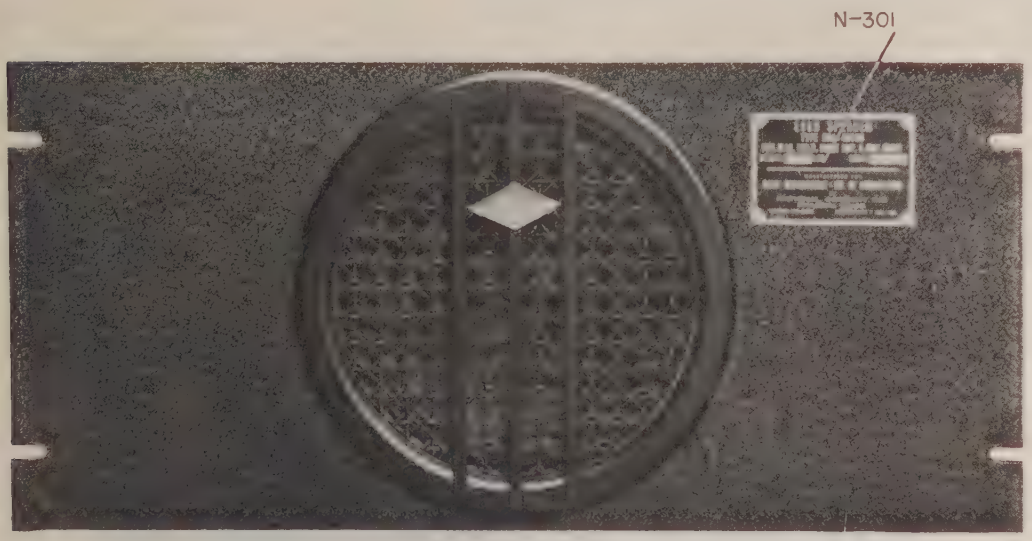



PHOTO NO. 17.05 FRONT VIEW OF LOUD SPEAKER

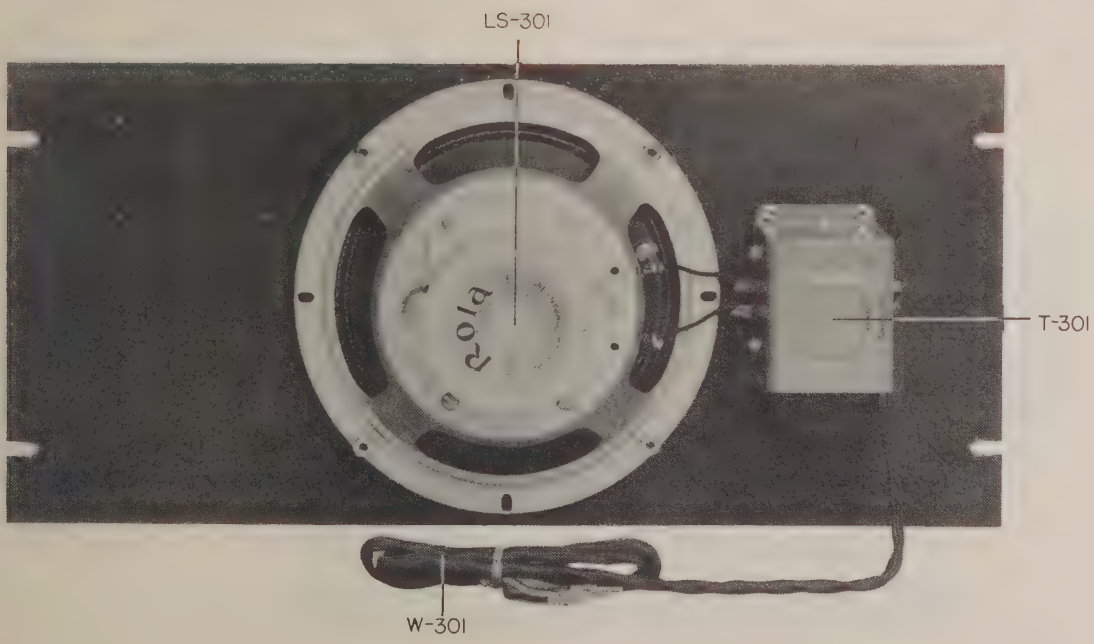



PHOTO NO. 17.06 REAR VIEW OF LOUD SPEAKER

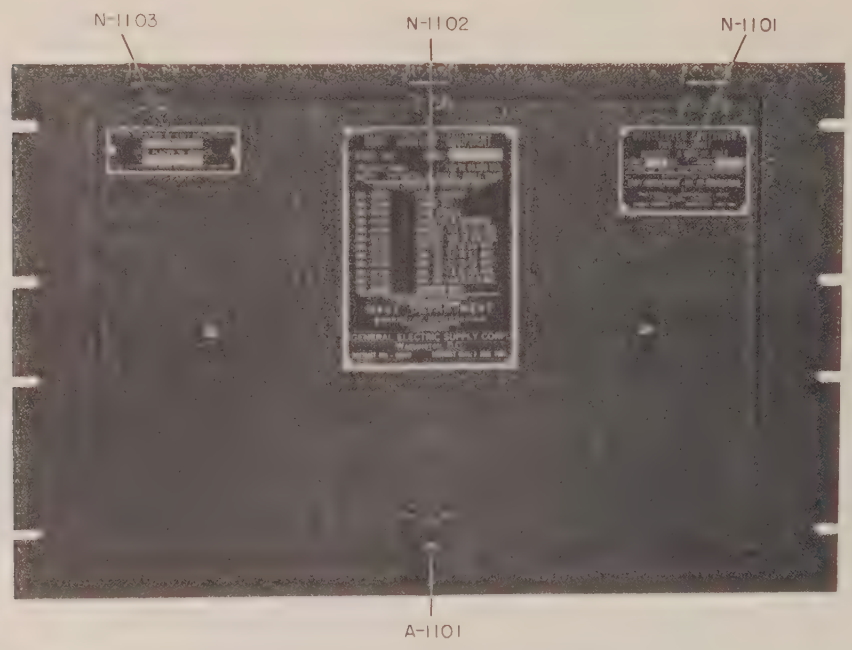



PHOTO NO. 17.07 FRONT VIEW OF COIL CONTAINER

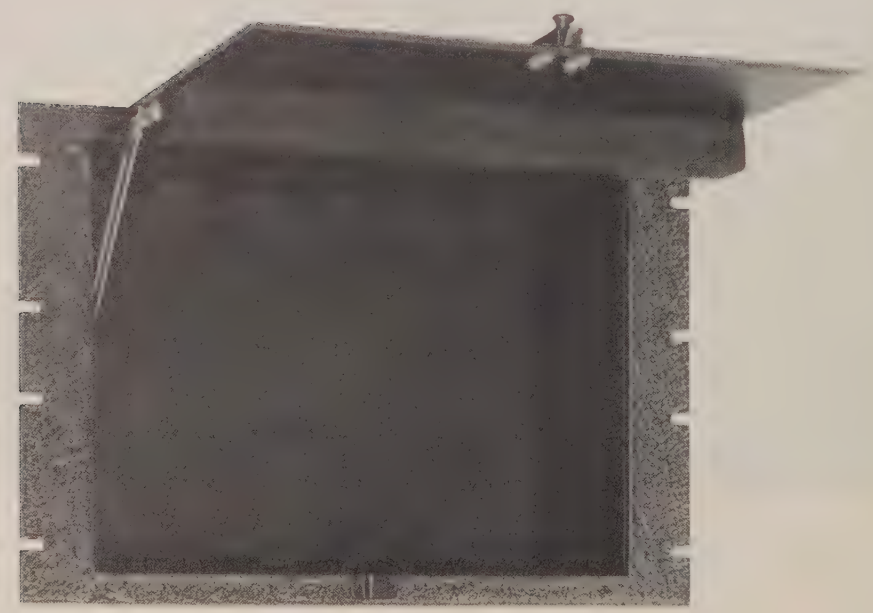


PHOTO NO. 17.08 INTERNAL VIEW OF COIL CONTAINER

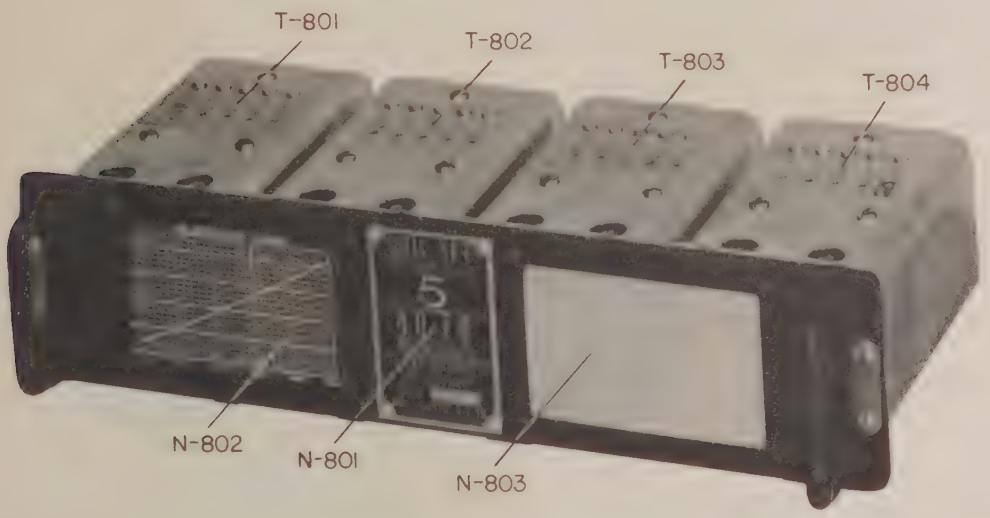



PHOTO NO. 17.09 TYPICAL COIL SET (SET NO. 5)

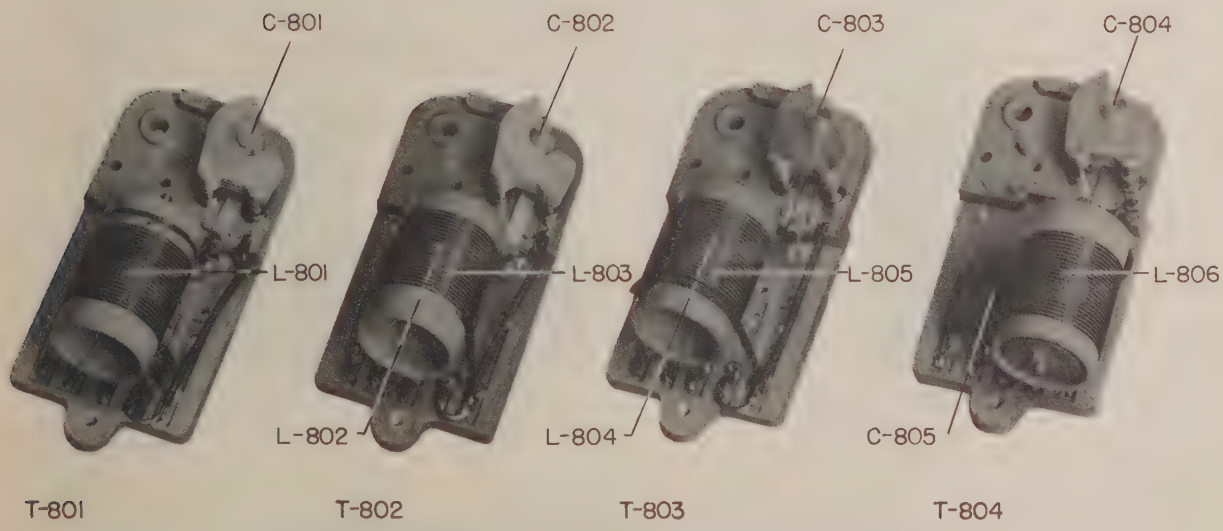



PHOTO NO. 17.10 R.F. TRANSFORMER SET NO. 5

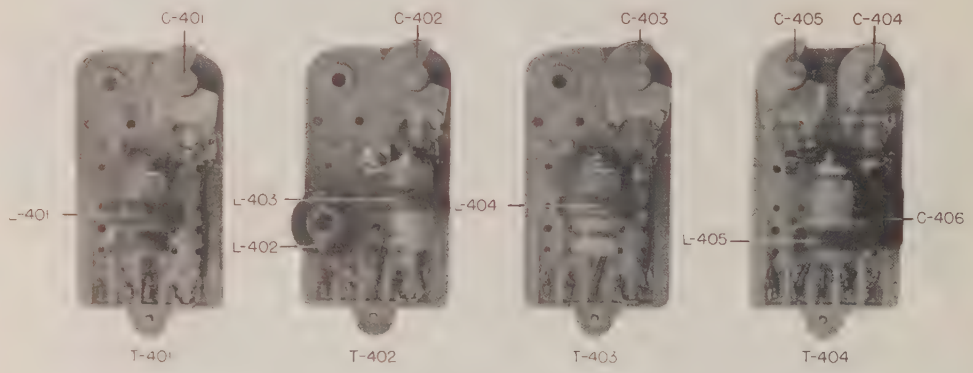



PHOTO NO. 17.11 R.F. TRANSFORMER SET NO. 1

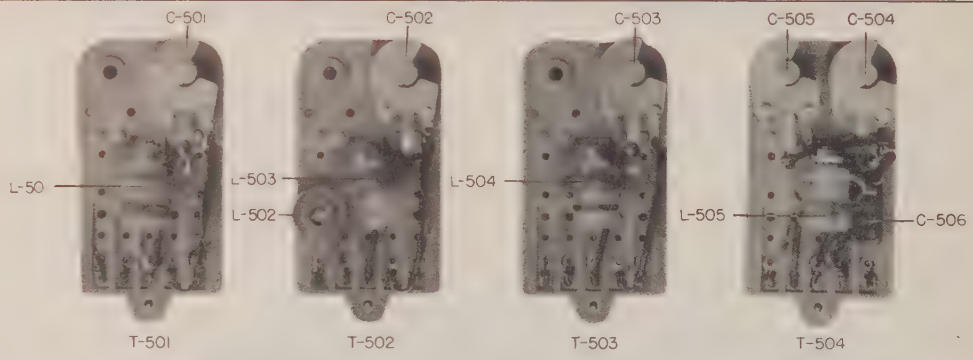



PHOTO NO. 17.12 R.F. TRANSFORMER SET NO. 2

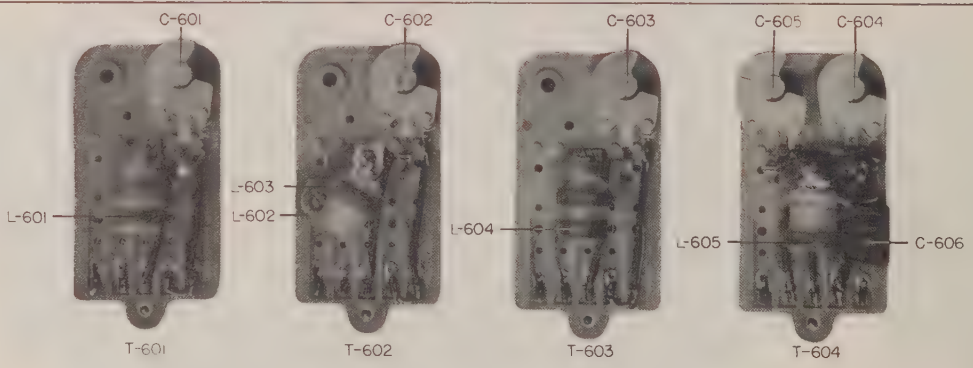



PHOTO NO. 17.13 R.F. TRANSFORMER SET NO. 3

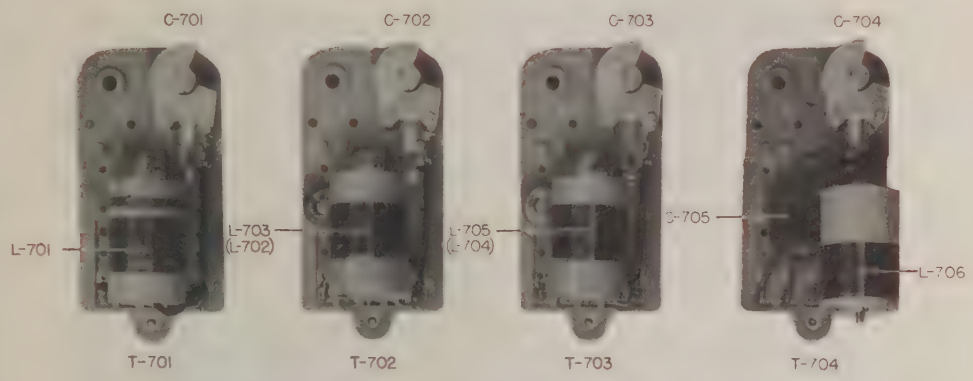



PHOTO NO. 17.14 R.F. TRANSFORMER SET NO. 4

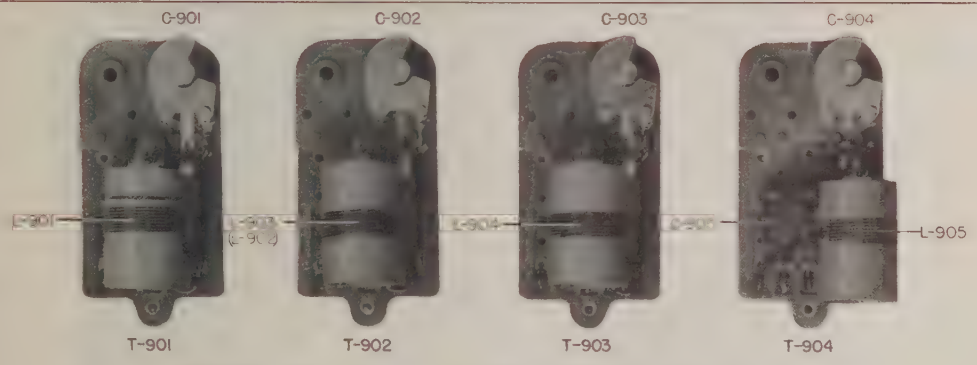



PHOTO NO. 17.15 R.F. TRANSFORMER SET NO. 6

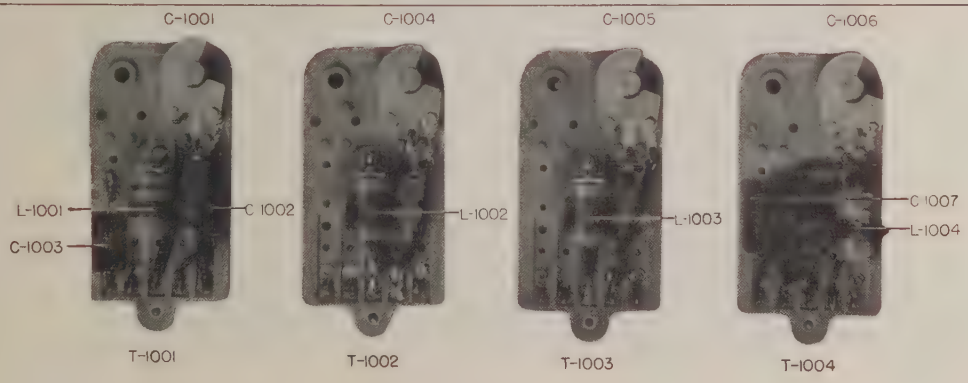



PHOTO NO. 17.16 R.F. TRANSFORMER SET NO. 7

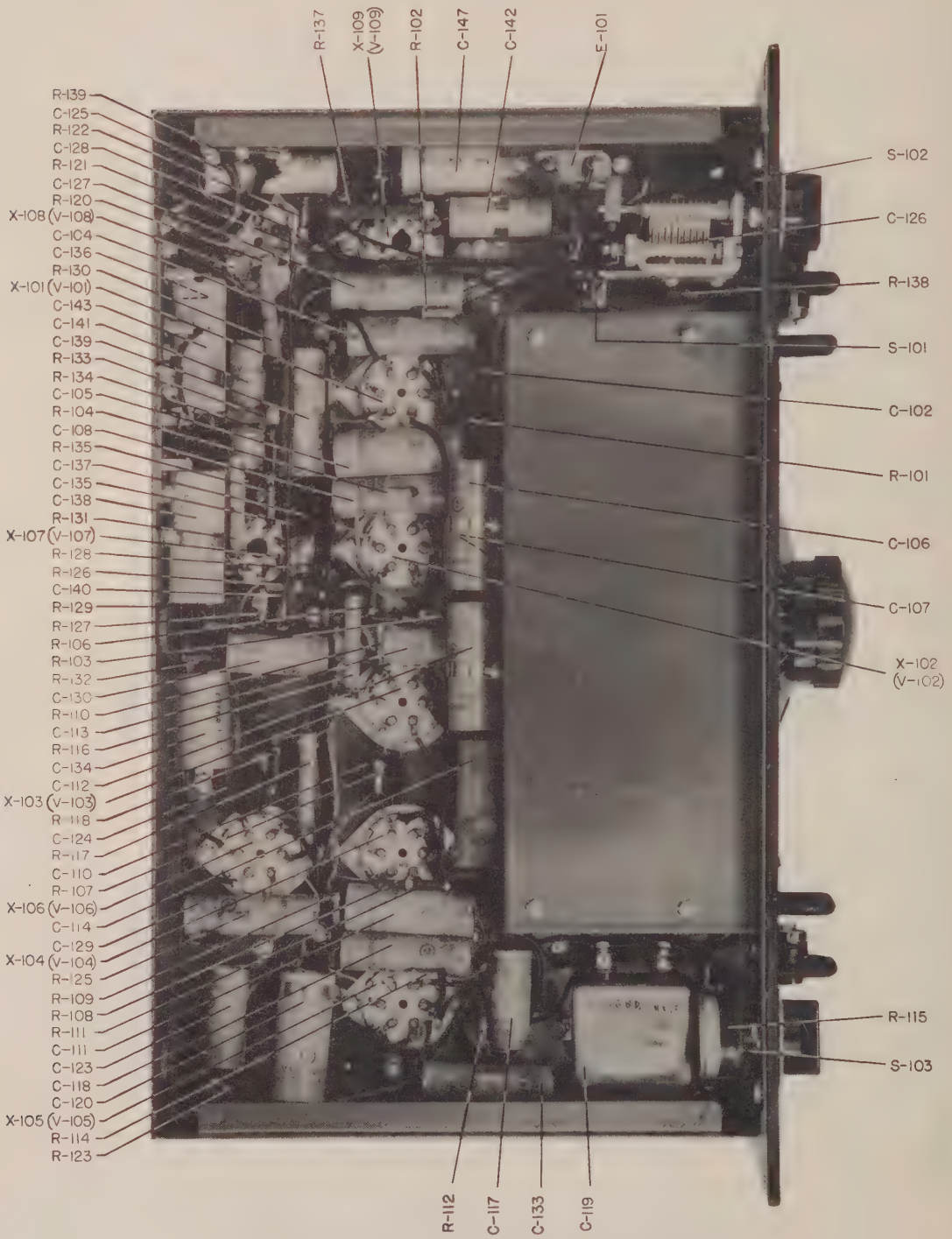



PHOTO NO. 17.17 BOTTOM VIEW OF RADIO RECEIVER

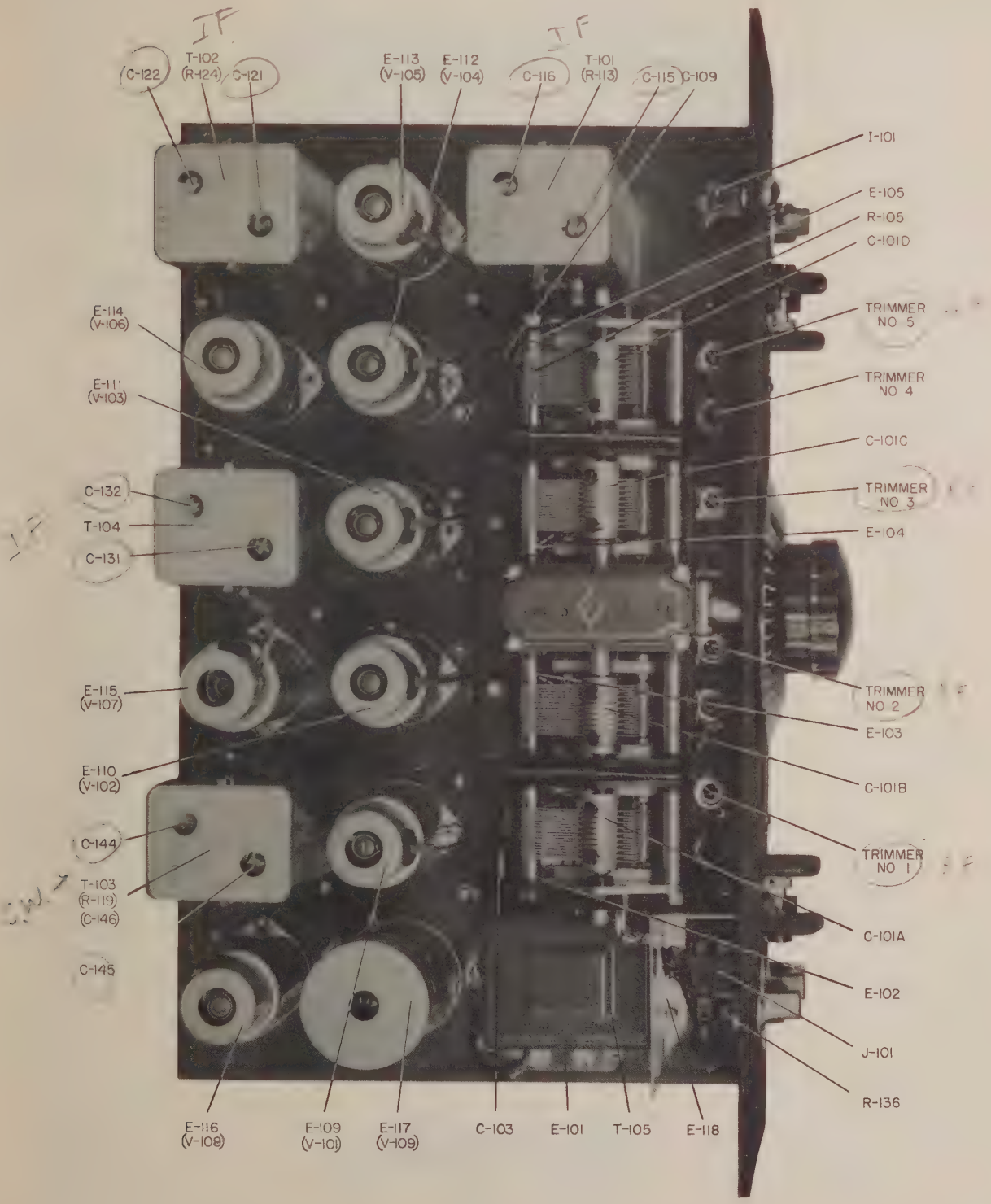



PHOTO NO. 17.18 TOP VIEW OF RADIO RECEIVER

PHOTOGRAPHS
OF

# AUXILIARY UNITS

## Type CNA-20089 Power Unit
## and
## Type CNA-49106 Loud Speaker Unit

PHOTO NO. 17.19 FRONT VIEW OF LOUD SPEAKER

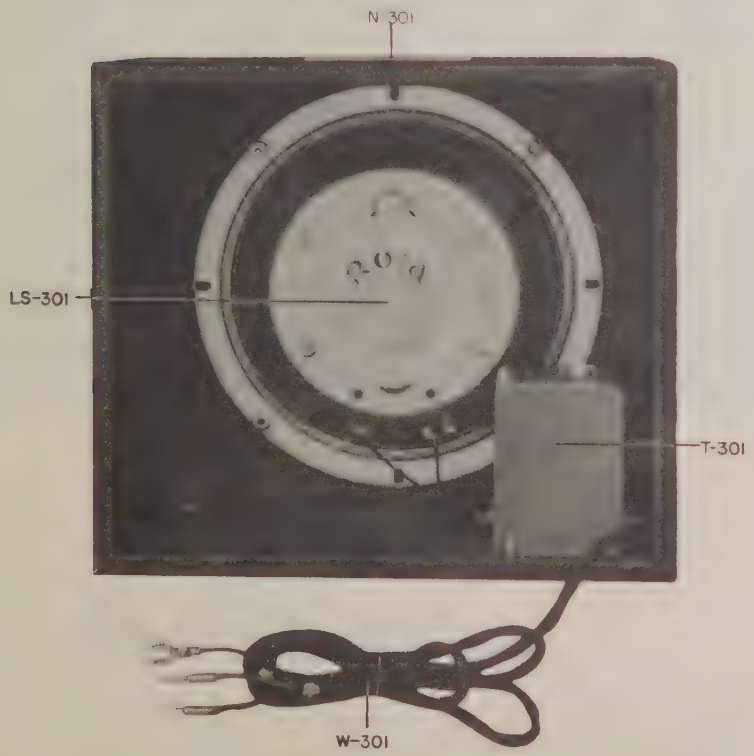



PHOTO NO. 17.20 REAR VIEW OF LOUD SPEAKER

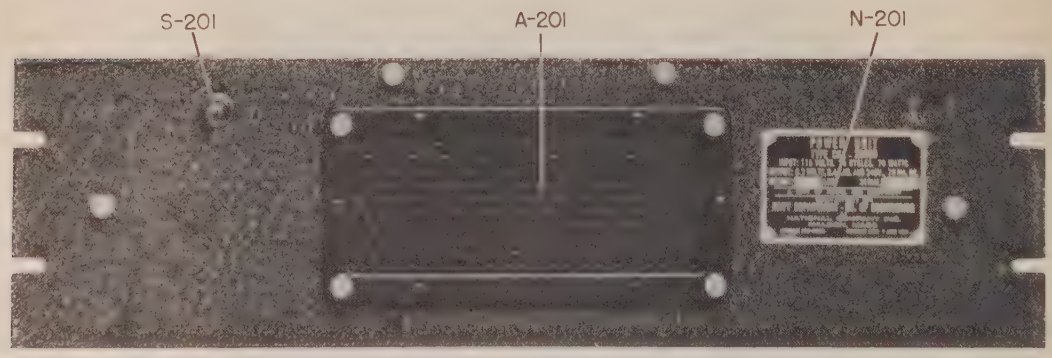



PHOTO NO. 17.21 FRONT VIEW OF POWER UNIT

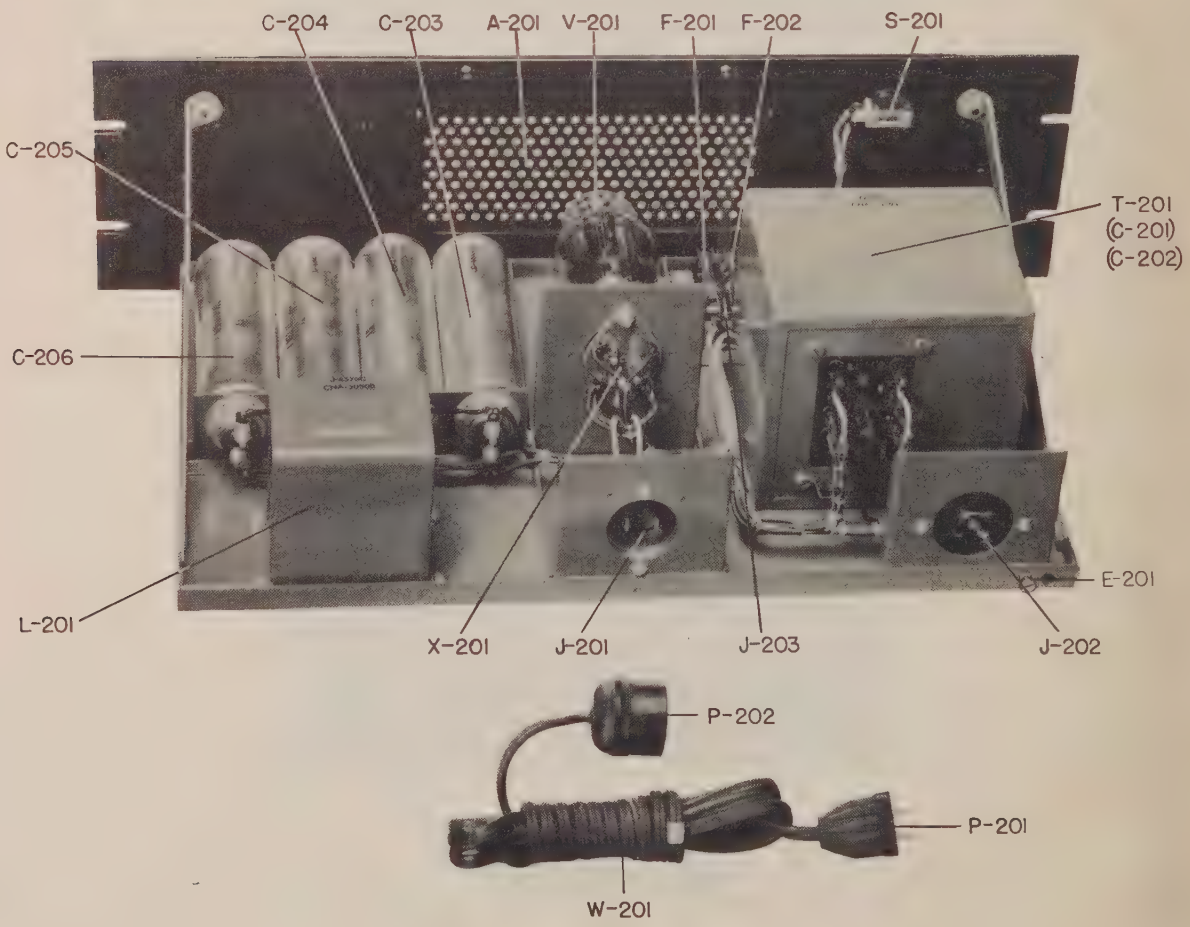



PHOTO NO. 17.22 INTERNAL VIEW OF POWER UNIT

16-R- RAS-1
Spare Parts
Set # 17

5 of 5 pc

Ex-Pt - Form